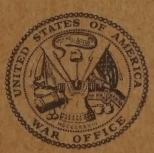
TM 11-606

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

RADIO RECEIVING SET AN/TRR-8



DEPARTMENT OF THE ARMY • *JUNE 1955*

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the 90-volt circuits

DON'T TAKE CHANCES!

TECHNICAL MANUAL
No. 11–606

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *21 June 1955*

RADIO RECEIVING SET AN/TRR–8

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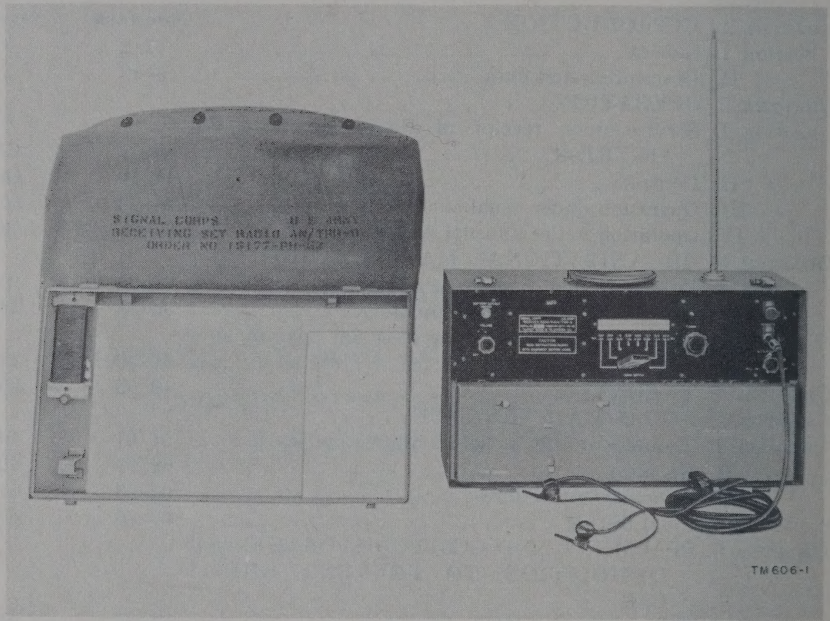


Figure 1. Radio Receiving Set AN/TRR–8.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual contains instructions for the installation, operation, maintenance, and repair of Radio Receiving Set AN/TRR–8 (fig. 1). This information is intended for operators, organizational maintenance repairmen, and field maintenance repairmen.

b. Forward comments on this publication direct to Commanding Officer, The Signal Corps Publication Agency, Fort Monmouth, New Jersey, ATTN: Standards Division.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army equipment and when performing preventive maintenance.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5.

b. DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

c. DA Form 11–238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 6).

d. DA Form 11–239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form (fig. 7).

e. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Radio Receiving Set AN/TRR–8 (fig. 1) is a wide-range, highly sensitive, portable radio set. Its light weight and extensive frequency coverage make it suitable for the interception of enemy com-

munications near the front lines, for the monitoring of friendly communications, and for general intercept applications.

b. The radio set contains a battery-powered superheterodyne receiver, Radio Receiver R–104/TRR–8 (fig. 2), which is used to receive amplitude modulated (am) and continuous wave (cw) signals on eight bands covering the frequency range of .100 megacycles (mc) to 65 mc. The equipment may be transported from one operating site to another in Receiving Set Case CY–191/TRR–8. This case is used also as an operating mount for the receiver when it is in operation.

4. Technical Characteristics

Frequency range:	
Band 1	.100 mc to .220 mc.
Band 2	.220 mc to .500 mc.
Band 3	.500 mc to 1.10 mc.
Band 4	1.10 mc to 2.60 mc.
Band 5	2.60 mc to 6.00 mc.
Band 6	5.80 mc to 13.5 mc.
Band 7	13.4 mc. to 31.0 mc.
Band 8	30.0 mc. to 65.0 mc.
Receiver type	Superheterodyne.
Types of signals that can be received	Cw and voice.
Number of tubes	8.
Intermediate frequency:	
Bands 1, 3, 4, and 5	455 kc.
Bands 2, 6, 7, and 8	910 kc.
Power input:	
1.5 volts	400 ma.
90 volts	21 ma.
Power source required	Batteries BA–405/U and BA–419/U (one each).
Overall sensitivity:	
Am	2.5 uv on bands 1 through 7, and 8 uv on band 8 for a 4 to 1 signal-plus-noise to noise power ratio.
Cw	0.8 uv on bands 1 through 7 and 2.5 uv on band 8.
Output impedance	250 ohms at either of two output jacks.
Antenna:	
Whip	Antenna AN–45–H; 97 inches long when fully extended, 16.5 inches long when collapsed.
Auxiliary	100-foot length of insulated copper wire terminating in a battery clip at one end and attached to a phenolic reel at the other end.
Weight	31 pounds with batteries installed.

5. Nomenclature Assignments

A list of nomenclature assignments for some of the components of Radio Receiving Set AN/TRR–8 is given below. The common name is indicated beside the official nomenclature for each component.

Nomenclature	*Common name*
Radio Receiving Set AN/TRR–8	Radio set
Radio Receiver R–104/TRR–8	Receiver
Receiving Set Case CY–191/TRR–8	Carrying case
Antenna AN–45–H	Antenna
Headset HS–30–U	Headset

6. Packaging Data

a. When packed for export shipment, the radio set is placed in a moisture-vaporproof container and packed in a wooden export crate that is 15 inches high by 26 inches wide by 11 inches deep. A cutaway view of an equipment packed for export is shown in figure 4. The volume of the crate is 2.5 cubic feet. The total weight of the crated radio set is 30 pounds.

Note. Items may be packaged in a manner different from that shown, depending on the supply channel.

b. The following list indicates the contents of the case. See the packing list attached to the case for exact contents.

1 Radio Receiver R–104/TRR–8, with tubes installed
1 Receiving Set Case CY–191/TRR–8
1 Antenna AN–45–H
1 auxiliary antenna
1 Receiving Set Case CY–1497/G (canvas bag)
1 Cord CD–874
1 Headset HS–30–U
1 set of running spares
2 manuals.

Note. The receiver requires one Battery BA–405/U and one Battery BA–419/U for operation. These are not packed with the equipment and must be requisitioned separately through regular supply channels.

7. Components

(figs. 2 and 3)

Component	Required No.	Height (in.)	Depth (in.)	Width (in.)	Volume (cu ft)	Unit weight (lb)
Radio Receiver R–104/TRR–8.	1	5½	5	21	0. 33	12
Receiving Set Case CY–191/TRR–8.	1	11½	6⅛	21¼	. 84	8. 88
Receiving Set Case CY–1497/G.	1	11¾	8	21¾	1. 21	2. 25
Antenna AN–45–H	1			16½ in. collapsed; 97 in. fully extended.		. 69
Auxiliary antenna	1			1,200 in. fully unreeled.		. 50
Cord CD–874	1			78		. 33
Headset HS–30–U	1	5	3	6⅜	. 05	. 34
Running spares	1 set					
Technical manual	2	9⅛		5⅞		
Total						25

Note. This list is for general information only. See appropriate supply publications for information pertaining to requisition of spare parts.

8. Description of Radio Receiver R–104/TRR–8

a. Radio Receiver R–104/TRR–8 (fig. 2) is an eight-tube superheterodyne receiver for reception of am and cw signals on eight bands in the frequency range of .100 mc to 65 mc. It is housed in Receiving Set Case CY–191/TRR–8, which also serves as a portable operational mount.

b. The cover of Receiving Set Case CY–191/TRR–8 may be removed by unfastening the two clasps at the top and sliding the cover outward to the left. The front panel of the receiver, on which all manually operated receiver controls are situated, will then be visible. When the cover is in place, it presses against the BATTERY CUT-OUT SWITCH (push button) in the upper left corner of the front panel. When this switch is pushed in, it prevents power from being applied to the receiver.

c. The cover of the compartment below the receiver may be removed by loosening the fasteners on the sides of the cover about ¼ turn with a screw driver. One section of this compartment houses Battery BA–405/U and Battery BA–419/U (fig. 2). The other section contains 10 spare tubes mounted in sockets.

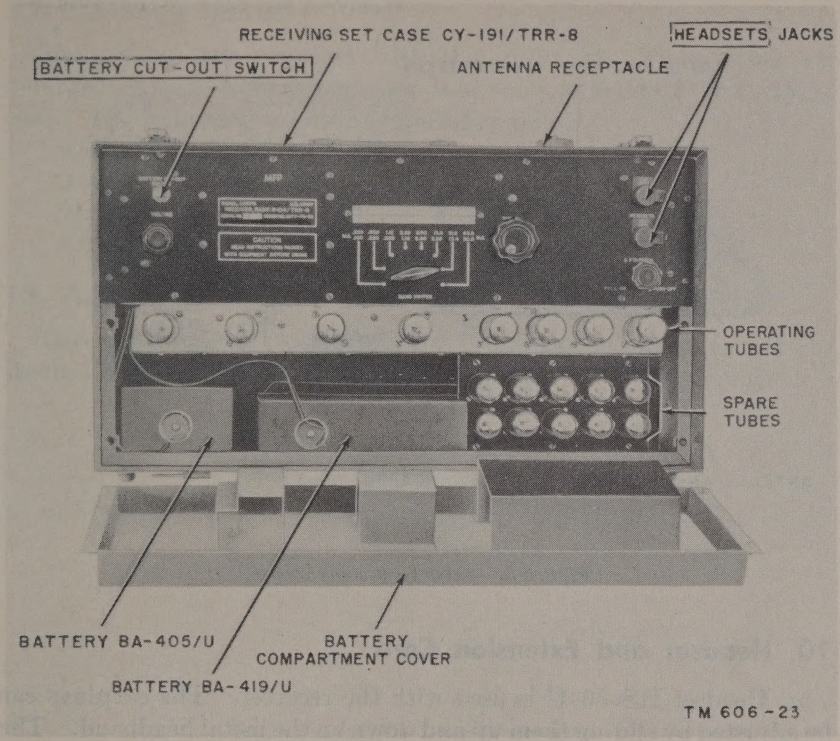


Figure 2. Radio Receiver R–104/TRR–8, front view with battery compartment cover open.

d. The eight operating tubes of the receiver are inclosed by the battery compartment cover below the receiver to protect the tubes and to prevent hand capacitance effects during operation.

e. An antenna receptacle with a cap cover is located on top of Receiving Set Case CY–191/TRR–8. When the cap is unscrewed, Antenna AN–45–H can be inserted into the receptacle for connection to threaded antenna input jack J1 in the receiver. The rubber washer on the opening of the antenna receptacle provides a snug fit for the antenna. The opening is protected on the inside by a rubber grommet and is splashproof.

9. Description of Antenna AN–45–H

Antenna AN–45–H (fig. 3) is a collapsible whip antenna. It is stored on the inside surface of the cover of Receiving Set Case CY–191/TRR–8 and is installed in the antenna receptacle on top of the carrying case when it is in use. When extended to its full length of 97 inches, the antenna satisfactorily covers almost the entire frequency range of the receiver.

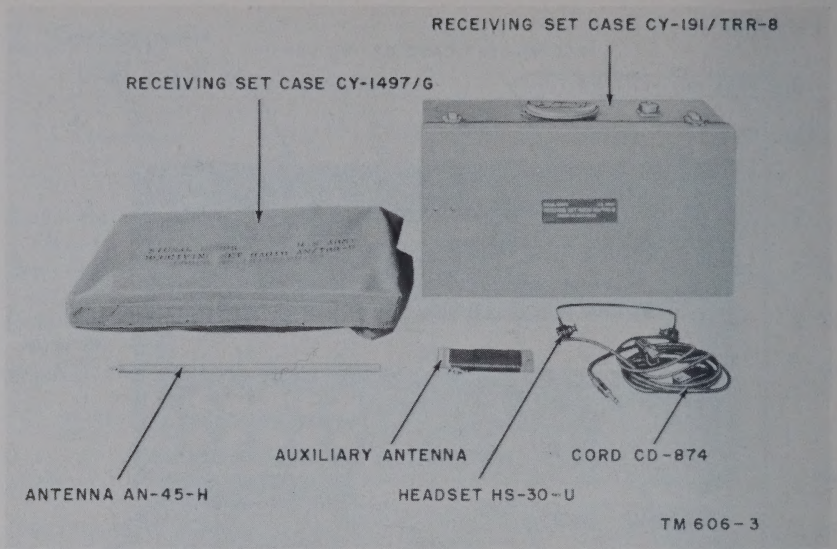


Figure 3. Accessory components.

10. Headset and Extension Cord

a. Headset HS–30–U is used with the receiver. The earplugs can be adjusted by sliding them up and down on the metal headband. The earphones are of the magnetic type.

b. Cord CD–874 is 78 inches long and is used as an extension cord for Headset HS–30–U. Plug PL–55, on the free end, fits into one of the HEADSETS jacks on the receiver. The cord allows the operator to stand erect while listening to the output of the receiver.

11. Description of Accessory Components

a. The auxiliary antenna (fig. 3) consists of a 100-foot length of insulated and stranded copper wire with a battery clip at one end; a phenolic insulator at the other end serves as a reel. This antenna is used to improve reception on the first three bands of the receiver. When not in use, it is stored inside the cover of the carrying case.

b. Receiving Set Case CY–191/TRR–8 houses all the components of the radio set and serves as a portable operational mount.

c. Receiving Set Case CY–1497/G is a canvas carrying bag that fits over the receiver carrying case to provide additional protection and camouflage for the radio set while it is being carried by the operator to and from the operating site.

12. Running Spares

Spare tubes are supplied with the radio set. These tubes are mounted on 10 sockets in the spare tube compartment of the carrying case. The following is a list of running spares:

2 tubes type 1LB4
2 tubes type 1LC6
2 tubes type 1LH4
4 tubes type 1LN5

13. Additional Equipment Required

Batteries BA–405/U and BA–419/U are not supplied as part of Radio Receiving Set AN/TRR–8 but are required for its operation.

CHAPTER 2

OPERATION

Section I. SERVICE UPON RECEIPT OF RADIO RECEIVING SET AN/TRR–8

14. Siting

a. The best location for radio equipment depends on the tactical situation and local conditions, such as the following: the need to house the equipment where its shelter cannot be seen; the type of housing available; the terrain; and the need of easy access to messengers.

b. If possible, Radio Receiving Set AN/TRR–8 should be situated on ground that is high and clear of hills, wooded areas, and other natural and man-made obstructions. The best reception can be expected on top of a hill. Depressions, valleys, and other low places are poor locations for radio reception because the surrounding high terrain absorbs radio-frequency (rf) energy. Weak or otherwise undesirable signals may be expected if the set is operated under or close to steel bridges, underpasses, hospitals, power lines, or power units.

15. Uncrating, Unpacking, and Checking New Equipment

Note. For used or reconditioned equipment, refer to paragraph 17.

a. General. Equipment may be shipped in oversea (export) packing cases or in domestic packing cases or, sometimes, in its own carrying case. When new equipment is received, select a location where the equipment may be unpacked without exposure to the elements and which is convenient to the installation of the equipment. The instructions in *b* below apply to equipment shipped in export packing cases. Aside from checking to see that the equipment is undamaged, no special unpacking and uncrating procedures are necessary for equipment shipped in its own carrying case.

Caution: Be careful when uncrating, unpacking, and handling the equipment; it is easily damaged. If it becomes damaged or exposed, a complete overhaul might be required or the equipment might be rendered useless.

b. Uncrating and Unpacking Export Shipments (fig. 4).

(1) Place the packing case as near the installation site as is convenient.

(2) Cut and fold back the steel straps.

(3) Remove the nails that secure the top of the packing case with a nail puller; remove the top of the packing case. Do not attempt to pry off the sides and top; the equipment may be damaged. Carefully set the case bottom side up and lift the case off the radio set.

(4) Remove the mositureproof barrier and any excelsior or corrugated paper covering the equipment inside the case.

(5) Open the outer corrugated carton and the inclosed moisture-vaporproof barrier.

(6) Remove the inner corrugated carton from the moisture-vaporproof container.

(7) Remove the equipment and the bags of desiccant from the inner corrugated carton, and place the equipment on or near its operating site.

(8) Check the contents of the packing case against the master packing slip.

c. Unpacking Domestic Packing Cases.

(1) Commercial containers are used in packing the radio set for domestic shipment. No desiccants or waterproof bags are inclosed. Open the containers and remove the equipment. Check the contents of the packing case against the master packing slip.

Note. If possible, save the original packing case and containers for both export and domestic shipments. They can be used again when the equipment is repacked for storage or shipment.

(2) Place the carrying case in position with the handle side up and its cover facing the operator.

(3) Unfasten the clasps on the cover of the case and remove it entirely by sliding it to the left.

d. Checking Equipment. Remove the cover labeled BATTERY COMPARTMENT and SPARE TUBE COMPARTMENT by loosening the two fasteners located on each side of the cover. This may be done with a screwdriver. Examine all tubes and be sure that they are seated firmly in their sockets and do not have cracked envelopes or bases. Be sure that the 10 running spare tubes stored in the sockets in the spare tube compartment have not been damaged. Inspect the headset, receiver chassis, antenna, and carrying case for possible damage caused by shipment. Replace the BATTERY COMPARTMENT and SPARE TUBE COMPARTMENT cover.

16. Installation and Connections of Radio Receiving Set AN/TRR–8

a. Choose a suitable operating site (par. 14).

b. Place the carrying case in position with the handle side up and its cover facing the operator.

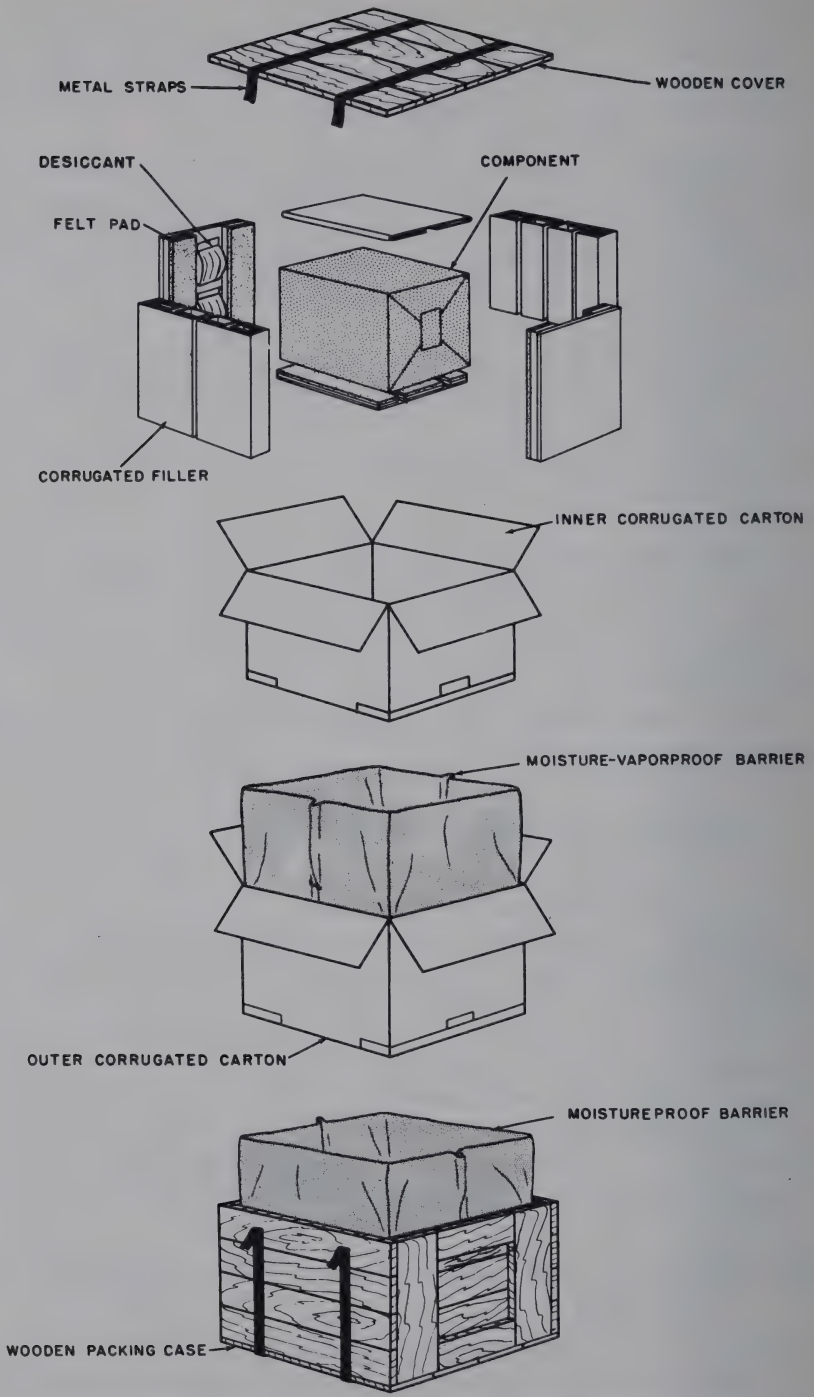


Figure 4. Packing and packaging of Radio Receiving Set AN/TRR–8.

c. Unfasten the clasps on the cover of the case and remove it entirely by sliding it to the left.

d. Remove the headset and the attached cord from the clips on the cover below the receiver front panel.

e. Insert Plug PL–55, on the free end of Cord CD–874, into either of the two front-panel jacks labeled HEADSETS (fig. 2).

f. Install the antenna as follows:

(1) Remove Antenna AN–45–H from inside the carrying case cover.

(2) Unscrew the antenna receptacle cap located on top of the carrying case to the right of the handle.

(3) Insert the antenna into the antenna receptacle as far as it will go and screw it in place. Extend the antenna to its full length.

g. Install auxiliary antenna as follows:

(1) Remove the auxiliary antenna from inside the carrying case cover.

(2) Connect the clip on one end of the auxiliary antenna to the base of Antenna AN–45–H.

(3) Unreel approximately 75 feet of the auxiliary antenna wire and tie the reel end to a post or tree. The antenna should be installed in a horizontal position.

h. Remove the cover marked BATTERY COMPARTMENT and SPARE TUBE COMPARTMENT (par. 15*d*). Install Battery BA–405/U and Battery BA–419/U in their proper positions in the battery compartment (fig. 2). Insert plugs P1 and P2 (connected to the two rubber-jacketed cables from the receiver) into the receptacles on the batteries. P1 is plugged into Battery BA–405/U; P2 is plugged into Battery BA–419/U. The plugs are keyed to the battery receptacles so that it is not possible to connect the cables incorrectly. The batteries are not supplied with the radio set and must be requisitioned through normal supply channels.

17. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 15 for uncrating, unpacking, and checking the equipment.

b. Check the used or reconditioned equipment for tags or other indications of changes in the wiring of the equipment. If any changes in wiring have been made, note the change in this manual, preferably on the schematic diagram. Include the serial and order numbers of the modified equipment.

c. Perform the installation and connection procedures given in paragraph 16.

Section II. CONTROLS

18. General

Haphazard operation or improper setting of the controls can cause damage to electronic equipment. For this reason, it is important to know the function of every control. The actual operation of the equipment is described in paragraphs 20 through 22.

19. Receiver Controls

(fig. 5)

The following chart lists the controls of the receiver and indicates their functions:

Control	Function
VOLUME control (R23 and S4)	In the OFF position, turns power off. When rotated clockwise, it turns receiver on and then is used as the volume control. Clockwise rotation increases the volume.
BATTERY CUT-OUT SWITCH (S3).	When the carrying case cover is on, it presses against this switch which turns off power to the receiver.
BAND SWITCH (S1)	Selects the desired frequency band.
TUNING control (C39)	Controls operating frequency of receiver within band selected by BAND SWITCH. Frequency is indicated on calibrated dial above BAND SWITCH.
B. F. O.-PITCH control (C35)	When the knob is pulled out, it turns the beat-frequency oscillator on; when pushed in, it turns the beat-frequency oscillator off. When the knob is turned, it varies the pitch of the audio tone in the receiver output if a cw signal is being received.
HEADSETS jacks (J2 and J3)	Two jacks to which two headsets can be connected.

Band	*Frequency (mc)*
1	.100– .220
2	.220– .550
3	.500– 1.10
4	1.10 – 2.60
5	2.60 – 6.00
6	5.80 –13.5
7	13.4 –31.0
8	30.0 –65.0

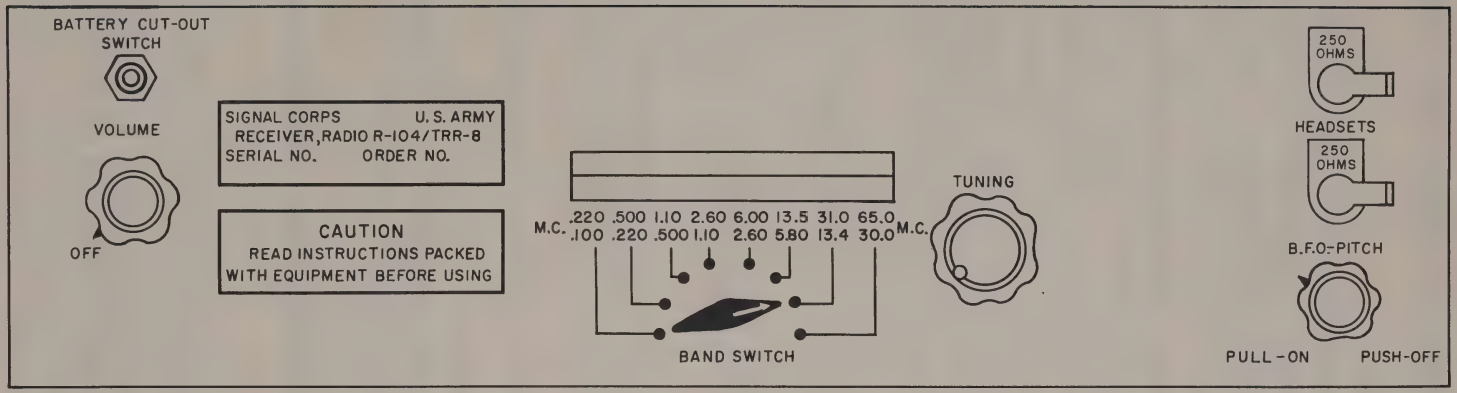


Figure 5. Radio Receiver R–104/TRR–8, front panel.

Section III. OPERATION UNDER USUAL CONDITIONS

20. Voice Reception

a. Set the BAND SWITCH to the desired band. The frequency range of each of the eight bands is indicated by two numbers marked on the panel above the BAND SWITCH.

b. Turn the VOLUME control clockwise until noise or signal is heard in the headset.

c. Turn the TUNING control until the hairline on the window is directly over the desired frequency marked on the tuning drum.

Note. For best reception, it may be necessary to turn the TUNING control slightly to either side of this position to tune in the signal properly.

d. Adjust the VOLUME control for a comfortable level of sound in the headset. If rotation of this control does not increase the sound level appreciably, increase the length of the auxiliary antenna until the signal level is improved. The auxiliary antenna is useful for operation on the first three bands.

Note. Full clockwise rotation of the VOLUME control does not give maximum sound in the receiver output. Too much volume may distort the output.

21. Cw Reception

a. Perform the procedures in paragraph 20*a* and *b*.

b. Pull out the B. F. O.-PITCH control and rotate it to its midway position.

c. Perform the adjustment given in paragraph 20*c*.

d. Rotate the B. F. O.-PITCH control clockwise and counterclockwise; stop when a clear tone of comfortable pitch is heard in the headset.

e. Adjust the VOLUME control as in paragraph 20*d*.

22. Stopping Procedure

To turn off the receiver, turn the VOLUME control to the OFF position. The receiver is also automatically turned off when the carrying case cover is replaced.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

23. General

The operation of Radio Receiving Set AN/TRR–8 may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In paragraphs 24 through 26, instructions are given on procedures for minimizing the effects of these unusual operating conditions.

24. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. If the set is not in a heated inclosure, construct an insulated box for the set.

c. Locate the equipment inside a heated inclosure where there is no danger of a cold draft striking the glass tubes when a door is opened.

d. Wear a knitted woolen cap over the earphones when operating in the open air with headsets that do not have rubber earpieces. Frequently, when headsets without rubber earpieces are worn, the edges of the ears may freeze without the operator being conscious of this condition. Never flex rubber earcaps; this action may render them useless. If water gets into the headset receivers, or if moisture condenses within them, it may freeze and impede the motion of the diaphragm. When this happens, disassemble the earphone and remove the ice and moisture from the receiver.

e. When equipment which has been exposed to the cold is brought into a warm room, it will sweat until it reaches room temperature. This condition also arises when equipment warms up during the day after exposure during a cold night. When the equipment has reached room temperature, dry it thoroughly.

f. Use any improvised means to protect the batteries, since they will fail if not protected against the cold. Preheat the batteries. To prevent heat loss, place them in bags lined with kapok, spun-glass fiber materials, animal skins, or woolen clothing.

25. Operation in Tropical Climates

When operated in tropical climates, the equipment is subjected to moisture conditions that are more acute than normal. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than that of the surrounding air. To minimize this condition, place lighted electric bulbs under the equipment.

26. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment.

b. The main problem that arises with equipment operation in desert areas is the large amount of sand and dirt that enters the moving parts of the radio equipment. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since, however, such a build-

ing is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and secure the side walls of tents with sand to prevent their flapping in the wind.

c. Keep the equipment as free from dust as possible. Remove dust from the carrying case and the front-panel controls of the receiver as often as necessary. The compartment below the receiver should remain covered unless the equipment is in a dustproof room. Make frequent preventive maintenance checks (pars. 31 and 32).

CHAPTER 3

ORGANIZATIONAL MAINTENANCE

Section I. PREVENTIVE MAINTENANCE SERVICES

27. Tools and Materials Supplied With Radio Receiving Set AN/TRR–8

No tools or materials for the maintenance of Radio Receiving Set AN/TRR–8 are supplied as part of the equipment. All tools and materials needed for such maintenance are contained in Tool Equipment TE–41 or Tool Equipment TE–113. These tool sets must be requisitioned through normal supply channels.

28. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from troubleshooting and repair in that its object is the prevention of troubles rather than their correction.

29. General Preventive Maintenance Techniques

a. Use No. 00 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with Solvent, Dry Cleaning (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

Caution: Repeated contact of carbon tetrachloride with the skin or prolonged breathing of the fumes is dangerous. Be sure adequate ventilation is provided. Do not use carbon tetrachloride on polyvinyl insulation; it is a solvent for this resin.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

d. For further information on preventive maintenance techniques, refer to TB SIG 178, Preventive Maintenance Guide for Radio Communication Equipment.

30. Use of Preventive Maintenance Forms

(figs. 6 and 7) .

a. The decision as to which items on DA Forms 11–238 and 11–239 are applicable to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

b. Circled items in figures 6 and 7 are partially or totally applicable to Radio Receiving Set AN/TRR–8. References in the ITEM block refer to paragraphs in the text which contain additional maintenance information.

31. Performing Exterior Preventive Maintenance

Caution: Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

a. Check for completeness and satisfactory condition of the radio set. The components of the radio set are listed in paragraph 7 and illustrated in figures 2 and 3.

b. Check suitability of the location and installation for normal operation (pars. 14 and 16).

c. Remove dirt and moisture from the antenna, receiver front panel, headseat, and carrying case.

d. Inspect all controls on the receiver front panel for binding, scraping, misalinement, and positive action.

e. Check the radio set for normal operation. (Refer to equipment performance check list (par. 39).)

f. Clean and tighten the exterior of the radio set, including the receiver front panel, BATTERY COMPARTMENT and SPARE TUBE COMPARTMENT cover, antenna receptacle, carrying case clasps, and handle.

g. Inspect the carrying case and antenna for rust, corrosion, and moisture.

h. Inspect the headset, cord, and auxiliary antenna for cuts, breaks, fraying, deterioration, and kinks.

i. Inspect the whip antenna for bent sections, corrosion, and loose fit.

j. Inspect the canvas bag for mildew, tears, and fraying.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT
RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: RADIO RECEIVING SET AN/TRR-8 | EQUIPMENT SERIAL NO.

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; Ⓧ Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT *(receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).* PAR. 31a							
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 31b							
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 31c							
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 15d							
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 31d							
6	CHECK FOR NORMAL OPERATION. PAR. 31e							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 31f		13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 31g		14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 31L	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 31h		15	INSPECT METERS FOR DAMAGED GLASS AND CASES.	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR. 31i		16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHER-PROOFING.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING. PAR. 31j		17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWER-STATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 31k		18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.	

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. PAR. 31m

DA FORM 1 MAY 51 11-238 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM 606-31

Figure 6. DA Form 11-238.

k. Inspect the receiver front-panel controls, HEADSETS jacks and covers, and battery jacks for looseness.

l. Clean the plastic dial window.

m. If defiiciencies noted are not corrected during inspection, indicate action taken for correction.

32. Performing Interior Preventive Maintenance

Caution: Disconnect the battery cables before performing the following operations. Upon completion, reconnect the cables and check for satisfactory operation (par. 39).

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: **RADIO RECEIVING SET AN/TRR-8**

EQUIPMENT SERIAL NO.:

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; I Adjustment, repair or replacement required; ① Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	COND.	NO.	ITEM	COND.
1	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (*receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories*). PAR. 31 a		19	ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS: INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES. PAR. 32 a	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION. PAR. 31 b		20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 31 c		21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION. PAR. 32 b	
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 15 d		22	INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS.	
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 31 d		23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR. 32 c	
6	CHECK FOR NORMAL OPERATION. PAR. 31 e		24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR. 32 d	
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 31 f		25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR. 32 e	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 31 g		26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE. PAR. 32 f	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 31 h		27	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR. 31 i		28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING. PAR. 31 j		29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 31 k		30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.		31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR. 31 g	
14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 31 l		32	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR. 31 h	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES.		33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES. PAR. 32 k	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.		34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.		35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.		36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
			37	MOISTURE AND FUNGIPROOF.	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. PAR. 32 L				

DA FORM 1 MAY 51 11-239 REPLACES DA FORM 419, 1 DEC 50, WHICH IS OBSOLETE. 16—44382-1

TM 606-32

Figure 7. DA Form 11-239.

a. Inspect the receiver tubes for loose envelopes, cracked sockets, and insufficient socket spring tension. Carefully clean dirt and dust from tubes and tube pins. Check emission of the receiver tubes on a tube tester such as Electron Tube Test Set TV–7/U (TM 11–5083).

b. Inspect the fixed capacitors for leaks, bulges, and discoloration.

c. Inspect the variable capacitors for dirt, moisture, shorting of plates, and loose mountings.

d. Inspect the resistors, bushings, and insulators for cracks, chipping, blistering, discoloration, and moisture.

e. Inspect the terminals of large fixed capacitors and resistors for corrosion, dirt, and loose contacts.

f. Clean and tighten switches S2, S3, and S4 and the receiver chassis.

g. Clean and tighten the connections and mountings for potentiometers, transformers, coils, and capacitors.

h. Inspect the transformers, coils, and potentiometers for discoloration, burns, unusual smell, and other evidence of overheating.

i. Inspect the batteries for signs of corrosion and deterioration.

j. Reassemble the radio set, tighten all mounting screws, and check for normal operation (par. 39).

k. If the equipment is to be shipped or stored, remove both batteries from the battery compartment.

l. If deficiencies noted are not corrected during inspection, indicate action taken for correction.

Section II. LUBRICATION AND WEATHERPROOFING

33. Lubrication

Radio Receiving Set AN/TRR–8 requires lubrication on the movable parts listed in *a* through *c* below. Every 3 months each part should be cleaned with Solvent, Dry Cleaning (SD) and then lubricated.

a. Control Shafts. Apply a few drops of Oil, Lubricating, Preservative, Medium (PL Medium) to the shafts and bushings of the VOLUME-OFF control, TUNING control, B. F. O.-PITCH control, and the BAND SWITCH. Wipe off the excess with a clean dry cloth.

b. Band Switching Mechanism. Lightly coat the bevel gears and the detent in the band switching mechanism with Grease, Aircraft and Instruments (GL). Operate the mechanism to spread the grease by turning the BAND SWITCH. Wipe off the excess with a clean, dry cloth.

c. Antenna. Place a few drops of oil (PL Medium) on a clean cloth and apply it to Antenna AN–45–H. Gently wipe off any excess oil with a clean cloth.

34. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment, and TB SIG 72, Tropical Maintenance of Ground Signal Equipment.

c. Arctic Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66, Winter Maintenance of Signal Equipment, and TB SIG 219, Operation of Signal Equipment at Low Temperatures.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75, Desert Maintenance of Ground Signal Equipment.

35. Rustproofing and Painting

a. When the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use No. 0 or No. 00 sandpaper to clean the surface down to the bare metal; obtain a bright smooth finish.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touchup job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with solvent (SD). In severe cases, it may be necessary to use solvent (SD) to soften the rust and to use sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations. Refer to TM 9–2851, Painting Instructions for Field Use.

Section III. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

36. Extent of Instructions

a. The troubleshooting and repairs that can be performed at the organizational maintenance level (operators and repairmen) are necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly,

troubleshooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out tubes, cracked insulators, etc.

b. The paragraphs which follow in this section will help to isolate the fault to the defective stage or item such as a tube or transformer.

37. Visual Inspection

a. Failure of this equipment to operate properly usually will be caused by one or more of the following faults:

(1) Improperly connected battery cables.
(2) Worn, broken, or disconnected cables, cords, or plugs.
(3) Wires broken because of excessive vibration.
(4) Defective tubes.

b. When failure is encountered and the cause is not immediately apparent, check as many of the items in *a* above as is practicable before starting a detailed examination of the component parts of the radio set. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

c. Inspect the whip and auxiliary antennas for obvious defects.

38. Troubleshooting By Using Equipment Performance Check List

a. General. The equipment performance check list (par. 39) will help the operator to locate trouble in the equipment. The list gives the item to be checked, the conditions under which the item is checked, the normal indications, and the corrective measures the operator can take. *To use this list, follow the items in numerical sequence.*

b. Action or Condition. For some items, the information given in the action or condition column consists of various switch and control settings under which the item is to be checked. For other items, it represents an action that must be taken to check the normal indication given in the normal indications column.

c. Normal Indications. The normal indications listed include signs that the operator should see and hear when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those the operator can make without turning in the equipment for repairs. A reference in the chart to chapter 5 indicates that the trouble cannot be corrected during operation and that troubleshooting by an experienced repairman is necessary. If the set is completely inoperative or if the recommended corrective measures do not yield results, troubleshooting is necessary. However, if the tactical situation requires that communication be maintained and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

350276 O—55——4

39. Equipment Performance Check List

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Battery cables	Plug into batteries.		
	2	Antenna AN–45–H	Screw into antenna receptacle and extend to maximum length.		
	3	Auxiliary antenna	Clip to base of whip antenna, unreel, and tie to tree or post.		
	4	Cord OD–874	Insert Plug PL–55 into one of the two HEADSETS jacks.		
START	5	B. F. O.-PITCH control	Push knob into OFF position.		
	6	BAND SWITCH	Set at .100–.220 M. C. position.		
	7	TUNING control	Rotate while observing the hairline on the tuning drum. The hairline should be at the desired frequency.		
	8	VOLUME control	Rotate clockwise for a comfortable noise or signal level in the headset.	Signals or noise in the headset.	Check batteries and receiver tubes.
	9	TUNING control.	Vary the control setting to both sides of the setting (item 7 above) until the desired signal is tuned in.	A loud, clear signal or loud background noise should be heard.	If the signal or the noise is weak, lengthen the auxiliary antenna, if possible. Check the receiver tubes.

EQUIPMENT PERFORMANCE	10	BAND SWITCH.	Turn to .220–.500 M. C.		
	11	TUNING control.	Turn to three frequencies in the band. The first at the low-frequency end, the second at the middle-frequency, and the third at the high-frequency end of the band.	Noise or signals are heard in the headset as the tuning control is advanced.	Refer to chapter 5.
	12	BAND SWITCH.	Set to the remaining six positions, and repeat item 11 above for each position of the BAND SWITCH.	Noise or signals are heard in the headset.	Refer to chapter 5.
	13	B. F. O.–PITCH control.	Pull out and turn control to its mid-position.		
	14	TUNING control	Turn until a cw carrier is received on band 8.	Code signals are heard in the headset.	Advance VOLUME control. Check tube V8.
	15	BAND SWITCH	Set to the remaining seven positions and repeat item 14 above for each position of the BAND SWITCH.	Code is heard in the headset on each band.	Advance VOLUME control. Refer to chapter 5.
STOP	16	VOLUME control	Turn to OFF	No noise or signals are heard in the headset.	

CHAPTER 4

THEORY

40. Block Diagram

(fig. 8)

a. General. Radio Receiver R–104/TRR–8 is an eight-tube superheterodyne receiver for receiving am and cw signals over the frequency range of .100 to 65 mc. This range is covered in eight bands. The frequency range for each band is as follows:

Band	*Frequency (mc)*
1	.100– .200
2	.220– .500
3	.500– 1.10
4	1.10 – 2.60
5	2.60 – 6.00
6	5.80 –13.5
7	13.4 –31.0
8	30.0 –65.0

b. Rf Amplifier. On bands 1 through 7, the signal is fed from the antennas to rf amplifier V1, where it is amplified and fed to mixer V2. On band 8, the signal is fed from the antennas directly to mixer V2. On bands 1 through 7, rf amplifier V1 also isolates high frequency (hf) oscillator V3 from the antennas.

c. Hf Oscillator. The output of hf oscillator V3 is coupled to mixer V2. On bands 1, 3, 4, and 5, the hf oscillator output frequency is 455 kilocycles (kc) above the signal frequency; on bands 2, 6, and 7 it is 910 kc above the signal frequency; on band 8, it is 910 kc below the signal frequency.

d. Mixer. Mixer V2 combines the rf amplifier output (bands 1 through 7) or the antenna (band 8) with the output of hf oscillator V3 to produce an intermediate frequency (if) of 455 kc (on bands 1, 3, 4, and 5) or 910 kc (on bands 2, 6, 7, and 8). The output of mixer V2 is fed to the grid of first if amplifier V4.

e. If Amplifiers. Intermediate-frequency amplifiers V4 and V5 select the if signal from mixer V2 and amplify the signal voltage. On bands 1, 3, 4, and 5, intermediate-frequency amplifiers V4 and V5 are tuned to 455 kc; on bands 2, 6, 7, and 8, they are tuned to 910 kc.

f. Detector and First Audio-Frequency Amplifier. The if output of V5 is coupled to detector and first audio-frequency (af) amplifier V6; there it is demodulated (detected) by the diode section of the

tubes and amplified by the triode section. After amplification, the af signal is fed to second af amplifier V7.

g. Second Af Amplifier. Second af amplifier V7 further amplifies the output of V6 to the proper level to be applied to the headset. It also matches the impedance of the output circuit to that of the handset.

h. Beat-Frequency Oscillator. Beat-frequency oscillator (bfo) V8 is used when receiving unmodulated cw signals and is turned on by B. F. O.-PITCH control switch S2. The oscillator generates a signal of 454 kc to beat with the 455 kc if of the receiver on bands 1, 3, 4, and 5. On bands 2, 6, 7, and 8, the second harmonic of 454 kc is used to beat with the 910-kc intermediate frequency of the receiver. The output of the bfo is coupled to if amplifiers V4 and V5 by radiation to their grid circuits.

i. Voltage Sources. The receiver uses Battery BA-419/U to supply +90 volts for all receiver circuits. Battery BA-405/U is used to supply −1.5 volts for the receiver filaments and bias circuits. VOLUME switch S4 connects the filament voltage to all the receiver tubes. BATTERY CUT-OUT SWITCH S3 disconnects all power from the receiver and is actuated by replacing the carrying case cover.

41. Antenna Tuning Circuit

(fig. 9)

a. High impedance whip antenna E3 (Antenna AN-45-H, plugged into antenna receptacle J1), and auxiliary antenna E1 (connected to antenna E3 by clip E2) are connected to any one of eight tuned circuits by wafer A of BAND SWITCH S1. BAND SWITCH S1 is a 13-section rotary switch shown in its entirety on the complete schematic diagram (fig. 26). When S1 is set at position 1 (.100 to .220 M. C.), S1A connects the antennas to a pi-section tuned circuit that consists of L5C, C89, and L12. This section matches the antenna impedance to the impedance of the grid circuit of rf amplifier V1. Switch section S1B connects TUNING capacitor C39A and padder capacitor C38 across the selected tuned circuit and connects the signal to the grid of rf amplifier V1 through coupling capacitor C1. Padder capacitors C38, C41, and C79 (fig. 26) are in series with variable capacitors C39A, C39B, and C39C (fig. 26) and reduce the circuits' capacitance to the proper range for the tuned circuits which they serve. This allows the antenna, mixer, and oscillator tuned circuits to track properly when the TUNING control is varied. Variable capacitor C89 is used for alinement at the high-frequency end of band 1. The adjustable powdered iron core L12 is used for alinement at the low-frequency end of band 1. TUNING capacitor C39A tunes the circuit to the desired frequency in the band.

b. The antenna tuning circuits for bands 2, 3, and 5 are similar to band 1 (fig. 26). The tuned circuit for band 4 consists of transformer

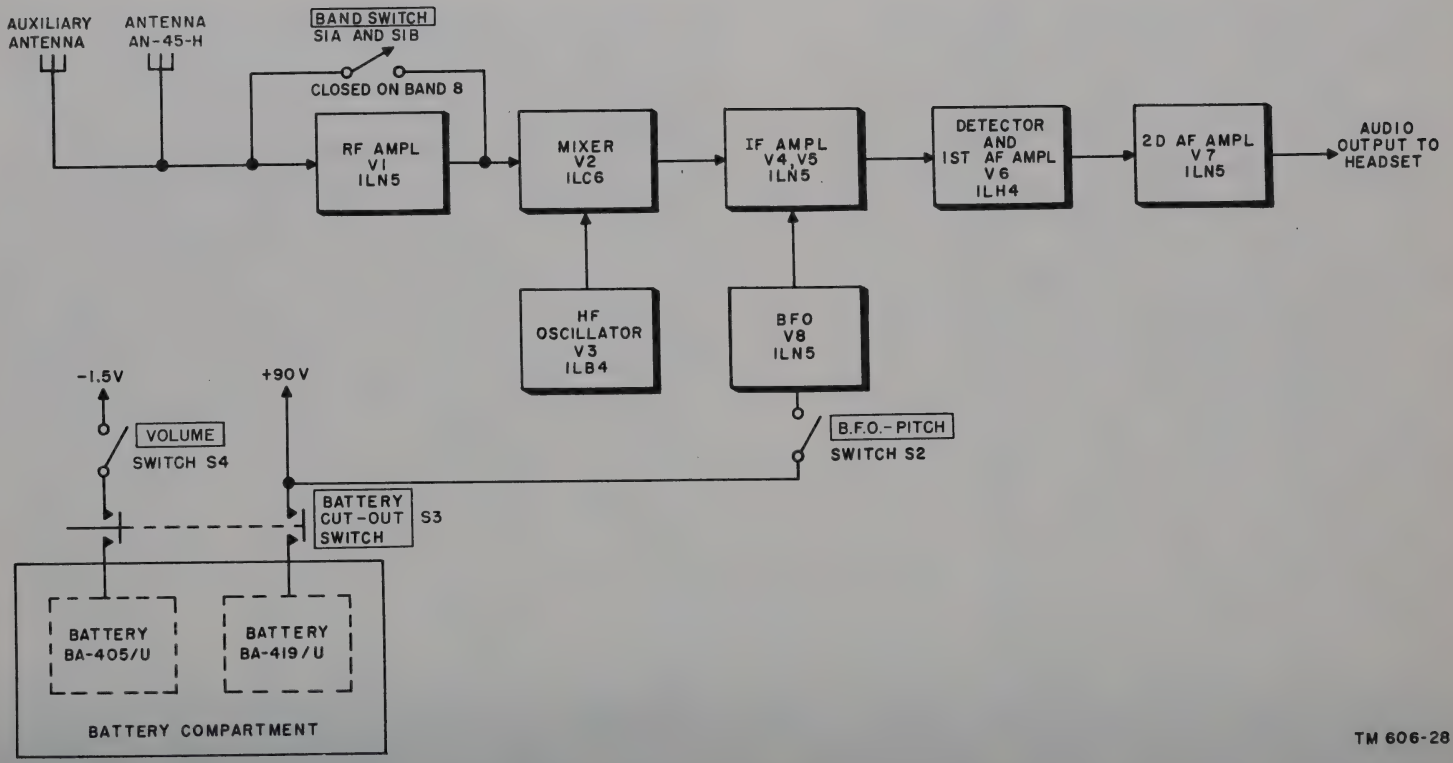


Figure 8. Radio Receiver R–104/TRR–8, block diagram.

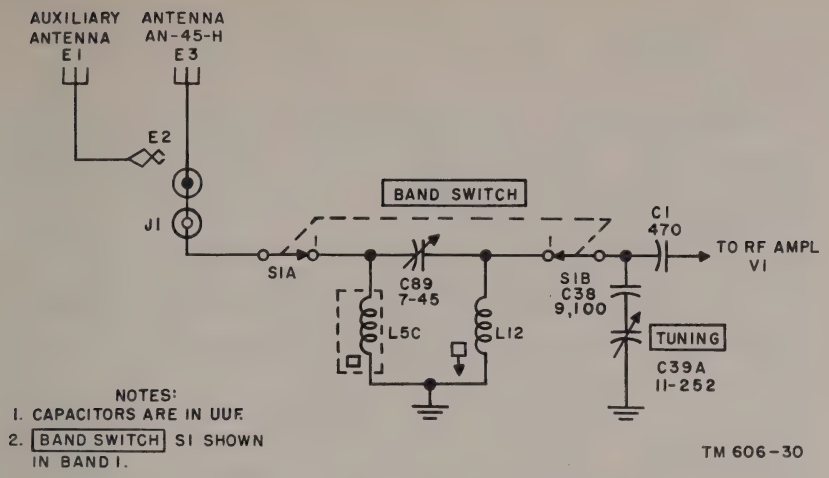


Figure 9. Antenna tuning circuit for band 1.

T13 with a tuned secondary circuit. The tuned circuits for bands 6, 7, and 8 are pi-sections with capacitor inputs. On band 8, TUNING capacitor C39B and compensating capacitor C41, switched into the circuit by S1D (fig. 26), are used to tune the circuit to the desired frequency. When operating on band 8, rf amplifier V1 is bypassed and the signal is fed directly to mixer V2 to prevent loss of signal at the higher frequencies. The rear section of S1B shorts out the antenna tuning circuit for the band immediately below the one in use to prevent spurious oscillations.

c. The following table lists the antenna tuning circuit components and adjustments for all positions of BAND SWITCH S1A and S1B. On bands 1 through 7, C39A, compensated by C38, is used to tune the circuit to the desired frequency. On band 8, C39B, compensated by C41, is used to tune the circuit to the desired frequency.

Band	Frequency (mc)	Tuned circuit	High frequency adjustment	Low-frequency adjustment
1	.100– .220	L5C, C89, L12	C89	L12
2	.220– .500	L15B, C80, L9	C80	L9
3	.500– 1.10	L5A, C74, L6	C74	L6
4	1.10 – 2.60	T13, C61	C61	T13
5	2.60 – 6.00	T8, C48	C48	T8
6	5.80 –13.5	C36, C37, L4	C37	L4
7	13.4 –31.0	C29, C28, L3	C28	L3
8	30.0 –65.0	C26, C25, L2	C25	L2

42. Rf Amplifier

(fig. 10)

a. The signal voltage from the antenna circuit is coupled through coupling capacitor C1, developed across grid resistor R1, and applied to the grid (pin 6) of rf amplifier V1. Grid bias is connected through R1 from the junction of R10 and R14.

b. VOLUME control R23 is connected between the negative terminal (pin 1) of the 90-volt battery and ground. The total plate and screen current of all tubes in the radio set flows through R23 and develops a negative voltage with respect to ground at the junction of R24 and R14 (fig. 10). For example, if the total plate and screen current drawn from the 90-volt supply is 20 milliamperes (ma) and if R23 is set for maximum resistance (750 ohms), the voltage at the junction of R23 and R14 would be −15 volts (750×.02). Resistors R14 and R10 form a voltage divider between this negative voltage and the −1.5-volt supply so that the potential at the junction of R14 and R10 is more negative than −1.5 volts and is controlled by adjustment of R23. Resistor R24 is in series with the movable arm of R23 to prevent R23 from being completely shorted out. This assures a minimum negative voltage at the junction of R23 and R14. A counterclockwise rotation of the VOLUME control knob increases the resistance of R23 and so increases the negative voltage at the junction of R23 and R14. Because this increases the negative bias at the grids of V1 and V4 (par. 45*a*), their gain is lowered and the volume of the set is reduced. Similarly, turning the VOLUME control clockwise reduces the resistance of R23 and increases the volume of the set. Capacitor C10 bypasses the rf voltage to the filament thus keeping it out of the bias circuits.

c. The signal is amplified by V1 and, on band 1, is developed across the primary of rf transformer T20. The primary of T20 is tuned by capacitor C90. This signal is induced in the secondary of T20, tuned by trimmer capacitor C91 and TUNING capacitor C39B. Capacitor C2 improves the coupling of the rf transformers at the higher frequencies. Capacitor C3 couples the output of T20 to the grid (pin 6) of mixer V2.

d. BAND SWITCH sections S1C rear and S1D front switch in the appropriate coupling transformer for bands 1 through 7. On band 8, rf amplifier V1 is not used, and the rear section of S1C grounds the plate (pin 2) of V1 through bypass capacitor C12 (fig. 26). On band 8, padder C41 is inserted in series with C39B to tune the input circuit of mixer V2 to the higher frequency required by band 8. On bands 1 through 7, C41 is shorted out by BAND SWITCH section S1D front. On bands 1, 2, and 3, a fixed capacitor is used to tune the primary of the rf transformer. On bands 4, 5, 6, and 7 the distributed

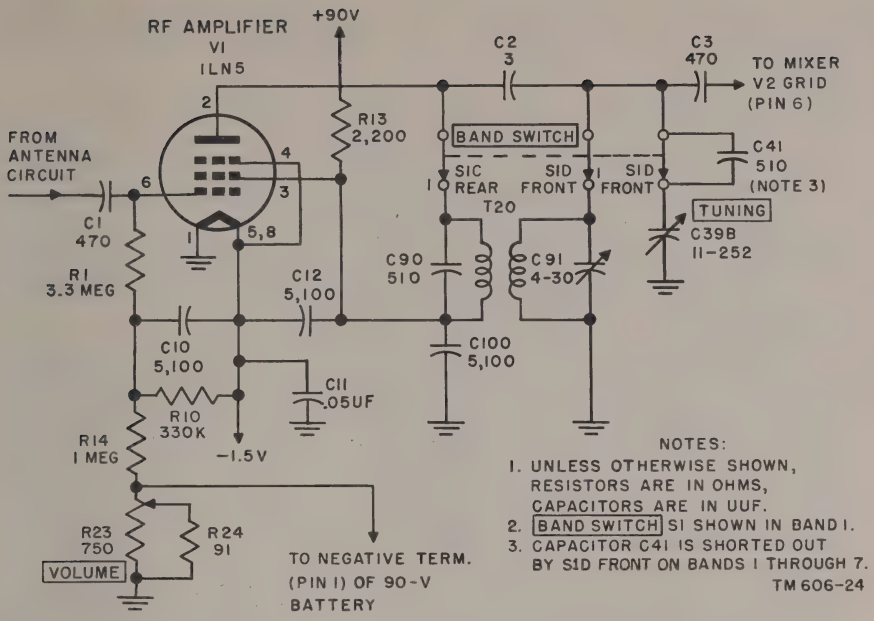


Figure 10. Rf amplifier.

capacity of the primary winding is used to tune the primary of the rf transformer. The rear section of S1D shorts out the transformer secondary for the band immediately below the one in use. The following table lists the transformer used, the primary tuning capacitor, and the secondary tuning capacitor for each position of BAND SWITCH S1C and S1D. The complete schematic diagram (fig. 26) shows all these components.

Band	Transformer	Primary tuning capacitor	Secondary tuning (trimmer) capacitor
1	T20	C90	C91
2	T19	C81	C82
3	T18	C102	C75
4	T14	Distributed capacity	C62
5	T9	Distributed capacity	C49
6	T6	Distributed capacity	C40
7	T3	Distributed capacity	C30
8	None	None	None

e. Plate voltage for tube V1 is applied through voltage dropping resistor R13, the primary of the coupling transformer, and the rear section of S1C. Bypass capacitor C100 prevents rf from entering the B+ supply. Screen voltage also is applied through decoupling re-

sistor R13 and bypassed for rf by capacitor C12. Capacitor C11 bypasses the filament circuit for rf.

43. Hf Oscillator

(fig. 11)

a. Hf oscillator V3 generates an unmodulated rf signal. For bands 1, 3, 4, and 5, the signal generated is 455 kc above the incoming signal frequency. For bands 2, 6, and 7 the oscillator generates a signal 910 kc above the incoming signal frequency. On band 8 the signal generated is 910 kc below the signal frequency.

b. Oscillation occurs in the tuned circuit connected between the plate and grid of V3. This circuit is completed through BAND SWITCH sections S1E rear and S1F rear. On band 1, the tuned circuit consists of L10B, TUNING capacitor C39C, padder capacitor C79, trimmer capacitors C92 and C93, and padder capacitors C94 and C95. These oscillations develop a hf voltage across the tuned circuit. Trimmer capacitors C92 and C93 and padder capacitors C94 and C95 form a capacitive voltage divider across the circuit. (Capacitors C93 and C94 are temperature compensating.) The portion of this hf voltage developed across padder capacitors C94 and C95 is applied to the grid (pin 6) of V3 through coupling capacitor C5 and developed across grid resistor R5. This hf voltage is amplified by tube V3 and again applied to the tuned circuit in the plate circuit of V3. This re-excites the tuned circuit and in turn again develops the hf voltage across the padder capacitors. The cycle repeats itself and oscillation is maintained. Grid-leak bias is developed across resistor R5. Capacitor C15 bypasses the filament circuit for rf.

c. Fixed trimmer capacitors C93 and C84 are in the tuned circuits for bands 1 and 2, respectively (fig. 26). Padder capacitor C79, in series with C39C, also is in the tuned circuit for bands 1 and 2. Padder capacitor C79 is shorted out on all bands except bands 1 and 2. On bands 4, 5, 6, 7, and 8, inductive feedback supplements the voltage developed across the padder capacitors. Bands 7 and 8 use the same tuned circuit. On band 7, the oscillator frequency is 910 kc above the signal frequency. On band 8, the second harmonic of the same oscillator frequency is used. This harmonic is 910 kc below the signal frequency received on band 8. BAND SWITCH section S1F front shorts out the tuned circuits for the two bands below the one in use. The trimmer capacitors are used for alinement at the high-frequency end of the bands and the padder capacitors are used at the low-frequency end of the bands.

d. TUNING capacitor C39C is a part of the tuned circuit for each band. The following table lists the other components of the tuning circuit for each position of BAND SWITCH S1E and S1F. The complete schematic diagram (fig. 26) shows all these components.

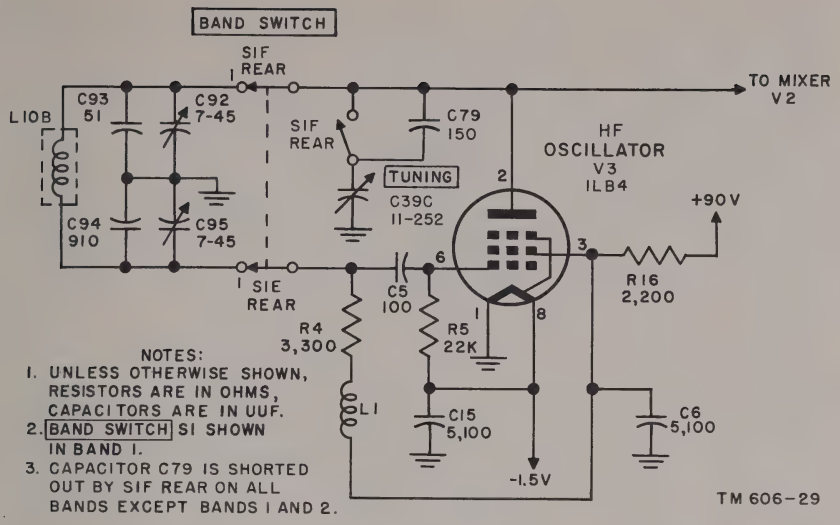


Figure 11. Hf oscillator.

Band	Tuned circuit	Trimmer adjustment	Padder adjustment
1	L10B, C92, C93, C94, C95, C79	C92	C95
2	L10A, C83, C84, C85, C87, C79	C83	C87
3	T15B, C76, C77, C78	C76	C78
4	T15A, C63, C64, C65	C63	C65
5	T7B, C50, C51, C52	C50	C53
6	T7A, C43, C44, C45	C53	C45
7	T4, C31, C32	C31	C32
8	T4, C31, C32	C31	C32

e. Plate voltage for V3 is applied through decoupling resistor R16, rf coil L1, voltage dropping resistor R4, switch section S1E rear, the tuned circuit coil, and switch section S1F rear. Screen voltage is applied through resistor R16. Rf coil L1 and bypass capacitor C6 prevent rf from entering the B+ supply. The output of hf oscillator V3 is coupled to the first grid (pin 4) of mixer tube V2 through coupling capacitor C4 (fig. 12).

44. Mixer

(fig. 12)

a. Mixer V2 combines the output of rf amplifier V1 (on bands 1 through 7) or the antenna signal (on band 8) with the output of hf oscillator V3, to produce an if. signal. Bands 1, 3, 4, and 5 use an if. signal of 455 kc. Bands 2, 6, 7, and 8 use an if. signal of 910 kc. The higher frequency bands, 6, 7, and 8, require the higher if. to provide

better image rejection and to keep the TUNING control from being excessively critical and hard to adjust. Band 2 includes 455 kc in its frequency range and therefore must use the 910 kc if.

b. The signal voltage from rf amplifier V1 (or the antenna) is coupled through capacitor C3, developed across grid resistor R2, and applied to one control grid (pin 6) of mixer V2. The hf output of hf oscillator V3 is coupled through capacitor C4, developed across R3, and applied to the other control grid (pin 4) of mixer V2. Fixed bias is applied to both grids through their grid resistors from the −1.5-volt supply. Bypass capacitor C13 shunts to ground any rf in the filament supply.

c. The two signals are mixed in the electron stream of tube V2 and several frequencies appear in the plate circuit of V2: the two original frequencies, the sum of the frequencies, the difference between the two frequencies, and harmonics of these frequencies. These frequencies are applied to if. transformer T11 on bands 1, 3, 4, and 5 (or if. transformer T16 on bands 2, 6, 7, and 8, fig. 26) through BAND SWITCH section S1G rear.

d. Each if. transformer accepts only the frequency to which it is tuned. Transformer T11 is tuned to the difference frequency of 455 kc and transformer T16 (fig. 26) is tuned to the difference frequency of 910 kc. The primary of T11 is tuned to 455 kc by temperature compensating capacitor C53 and trimmer capacitor C54A. The secondary of T11 is tuned to 455 kc by temperature compensating capacitor C56 and trimmer C54B. The primary of T16 is tuned to 910 kc by temperature compensating capacitor C66 and trimmer C67A (fig. 26) and the secondary is tuned to 910 kc by temperature compensating capacitor C69 and trimmer C67B. The required if. transformer is selected by BAND SWITCH sections S1G rear and S1H rear. All frequencies other than the difference frequency are filtered out by the if. transformer.

e. Plate voltage for V2 is applied through resistor R17, the primary of the if. transformer, and switch section S1G rear. Capacitor C101 and resistor R17 form a plate decoupling filter that keeps rf out of the plate voltage supply. Screen voltage is applied through voltage dropping resistor R15. Capacitor C14 is a screen grid bypass capacitor. The output of the mixer is coupled inductively by the if. transformer to first if. amplifier V4.

45. First If. Amplifier
(fig. 13)

a. The 455- or 910-kc if. voltage that is induced in the secondary or if. transformer T11 or T16 is applied directly to the grid (pin 6) of first if. amplifier V4. Grid bias for V4 is connected through isolating resistor R22 from the negative side of the 90-volt supply and is

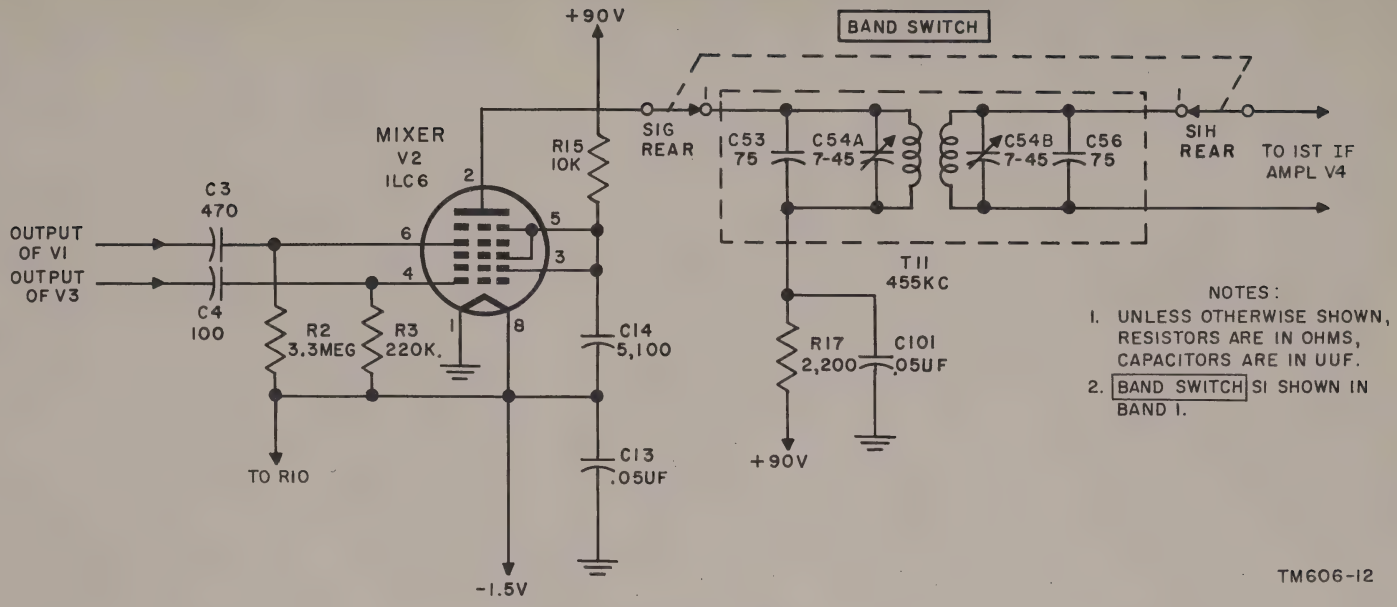


Figure 12. Mixer.

adjusted by the voltage drop across VOLUME control R23. When the resistance of R23 is increased, the negative voltage across R23 is increased. This applies more bias to V4, decreases its amplification and lowers the volume of the set. It also prevents V4 from being overlooked by strong signals. Refer to paragraph 42*b* for a complete discussion of this circuit.

b. The if. signal is amplified by V4 and applied to if. transformer T1. Intermediate-frequency transformer T1 is permanently tuned to 910 kc by the distributed capacitancy of its windings and by trimmer capacitor C18. Resistor R25 loads the secondary of T1 and increases the bandwidth of the transformer. Transformer T1 is permanently tuned to 910 kc. Therefore, intermediate-frequency amplifier V4 and the transformer provide no additional selectivity and very little amplification on bands 1, 3, 4, and 5 when the if. is 455 kc. The additional amplification is not necessary on the low-frequency bands because the lower signal frequencies receive more amplification per stage than the high band signal frequencies. The if. signal developed across trimmer capacitor C18 is coupled through dc blocking capacitor C7 to the grid of second if. amplifier V5.

c. Plate voltage for V4 is applied through isolating resistor R17, plate load resistor R6, and the primary of if. transformer T1. Bypass capacitor C101 and resistor R17 provide rf decoupling between the B+ supply and the plate and screen circuits. Screen voltage is applied through R17; the screen grid is bypassed by C17. Capacitor C16 bypasses rf from the filament supply.

46. Second If. Amplifier

(fig. 14)

a. The if. signal from first if. amplifier V4 is developed across grid resistor R7 and fed to the grid (pin 6) of second if. amplifier V5. Fixed bias is applied to the grid by connecting grid resistor R7 to the −1.5-volt supply. The if. signal is amplified by V5 and fed to if. transformer T12 (on bands 1, 3, 4, and 5) or T17 (on bands 2, 6, 7, and 8). BAND SWITCH sections S1I and S1J select the required if. transformer. The output of the if. transformer is fed to detector and first af amplifier V6.

b. Intermediate-frequency transformer T12 is tuned to 455 kc by temperature compensating capacitor C57 and C60 and trimmers C58A and C58B. Intermediate-frequency transformer T17 (fig. 26) is tuned to 910 kc by temperature compensating capacitors C70 and C73 and trimmers C71A and C71B.

c. Plate voltage for V5 is applied through isolating resistor R18, the primary of the if. transformer, and BAND SWITCH section S1I. Screen voltage is applied through R18. Bypass capacitors C20 and C99 and resistor R18 form an rf decoupling filter between

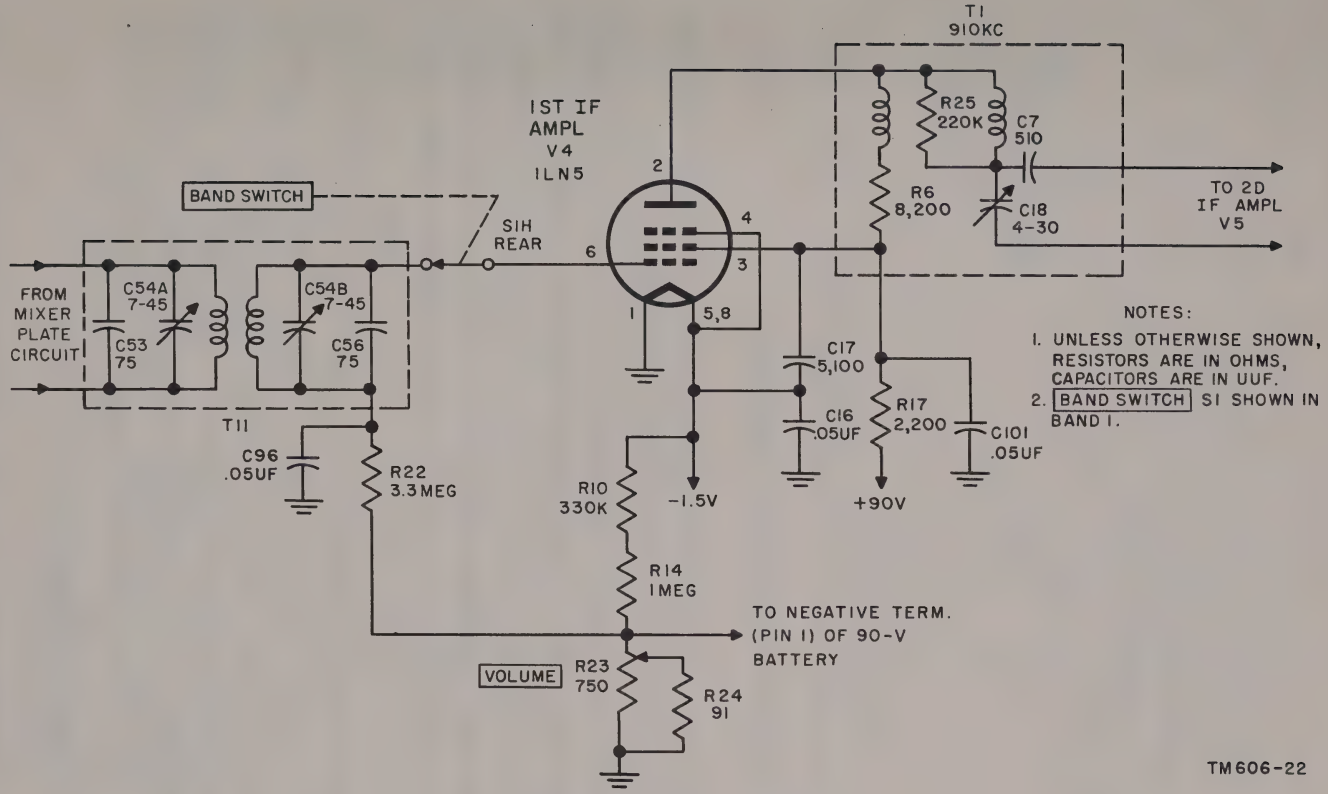


Figure 13. First if. amplifier.

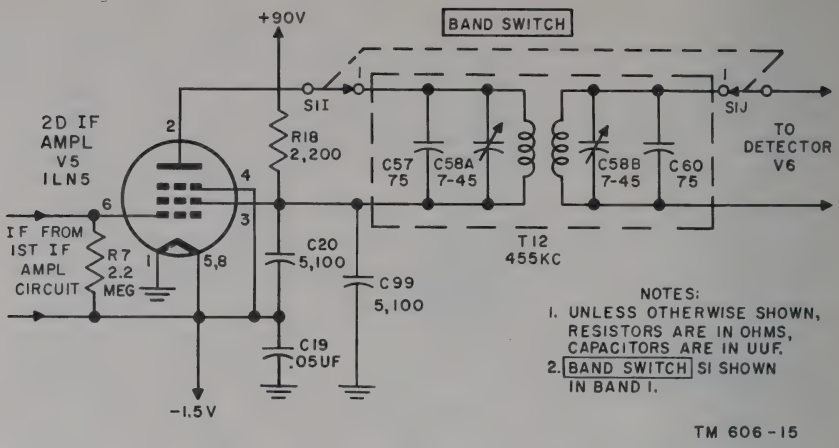


Figure 14. Second if. amplifier.

the B+ supply and the plate and screen circuits. Bypass capacitor C19 bypasses rf from the filament supply.

47. Detector and First Af Amplifier

(fig. 15)

a. Detector and first af amplifier V6 uses a dual-purpose tube, consisting of a diode detector and a triode amplifier.

b. The if. signal from second if. amplifier V5 is applied to the diode detector section of V6. The rectified voltage developed across diode load resistor R11 is bypassed for if. voltages by capacitor C21. This allows only audio and direct-current (dc) components of the signal to appear across the diode load resistor. An additional filter network consisting of capacitor C22 and resistor R12 provides further filtering of the if. voltage to insure complete rf bypassing of the diode load resistor.

c. The demodulated signal developed across diode load R11 is coupled through capacitor C8 and applied to the grid (pin 6) of the first af amplifier (triode section of V6). Capacitor C8 blocks the dc component of the demodulated signal and allows only the audio signal to appear at the grid. Fixed bias is applied to the grid by connecting grid resistor R8 to the −1.5-volt supply. The af signal is amplified by V6, developed across plate load resistor R19, and coupled through coupling capacitor C9 to second af amplifier V7. Bypass capacitor C23 bypasses rf from the filament circuit.

48. Second Af Amplifier

(fig. 16)

a. The audio output of V6 is coupled through capacitor C9, developed across grid resistor R9, and applied to the grid (pin 6) of

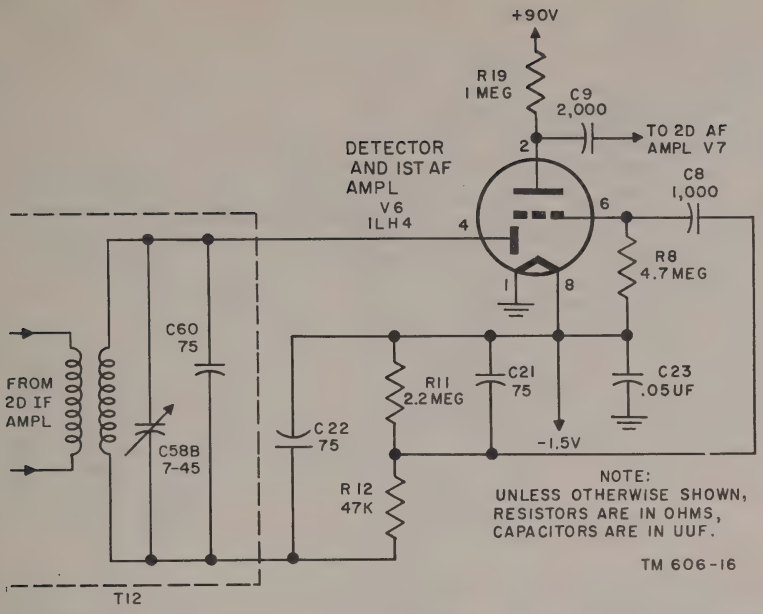


Figure 15. Detector and first af amplifier.

second af amplifier V7. Fixed bias is applied to the grid by connecting grid resistor R9 to the −1.5-volt supply. The audio signal is amplified by V7, a 1LN5 pentode-type tube connected as a triode, and applied across audio output transformer T2. Audio output transformer T2 provides a maximum transfer of audio power to the headset plugged into HEADSETS jack J2 or J3 by matching the impedance of the receiver output to the impedance of the headset.

b. Plate voltage is applied to V7 through decoupling resistor R20 and the primary of transformer T2. Capacitor C27 bypasses af around the B+ supply. Capacitor C24 removes any if. that was not filtered out in the diode detector circuit.

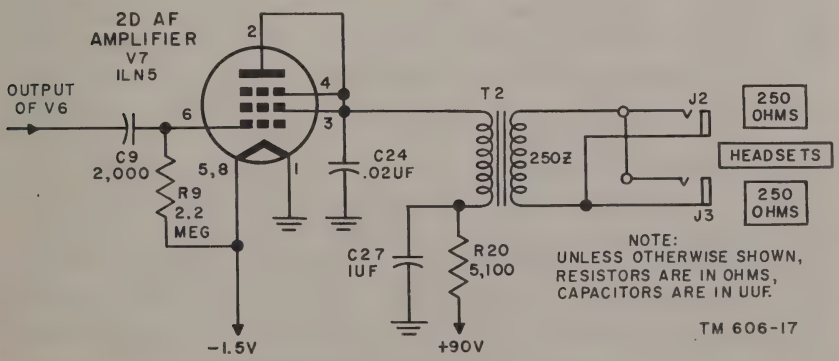


Figure 16. Second af amplifier.

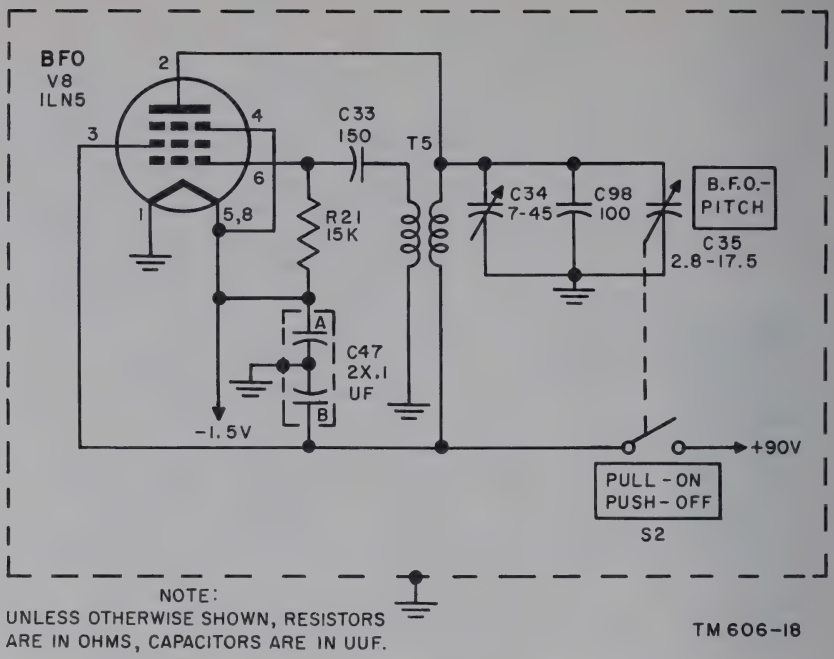


Figure 17. Beat-frequency oscillator.

49. Beat-Frequency Oscillator

(fig. 17)

a. The bfo is used when receiving unmodulated cw signals. It generates a signal that beats with the if. to produce an audio signal that may be heard in the headset. The bfo output normally is 454 kc, but on bands 2, 6, 7, and 8, the second harmonic is used.

b. Oscillation occurs in the plate tuned circuit of tube V8 when plate and screen voltages are applied by pulling the B.F.O.-PITCH control switch S2 to the ON position. The plate tank circuit consists of the primary of rf transformer T5, temperature compensating capacitor C98, trimmer C34, and B.F.O.-PITCH control C35. Trimmer capacitor C34 is adjusted so that the bfo output is 455 kc. when B.F.O-PITCH control C35 is at its midposition. The B.F.O.-PITCH control varies the bfo output 2,000 cycles per second (cps) on either side of 455 kc. Oscillation in the plate tank circuit is sustained by inductive feedback through transformer T5, which is coupled to the grid (pin 6) of tube V8 through coupling capacitor C33. The signal is amplified by V8 and returned to the plate tank circuit with enough energy to overcome circuit losses and maintain oscillation. Grid bias is developed across resistor R21. Part of the bfo output is applied to if. amplifiers V4 and V5 by radiation to their grid circuits. Both the if. and bfo signals are amplified by the if. amplifiers and

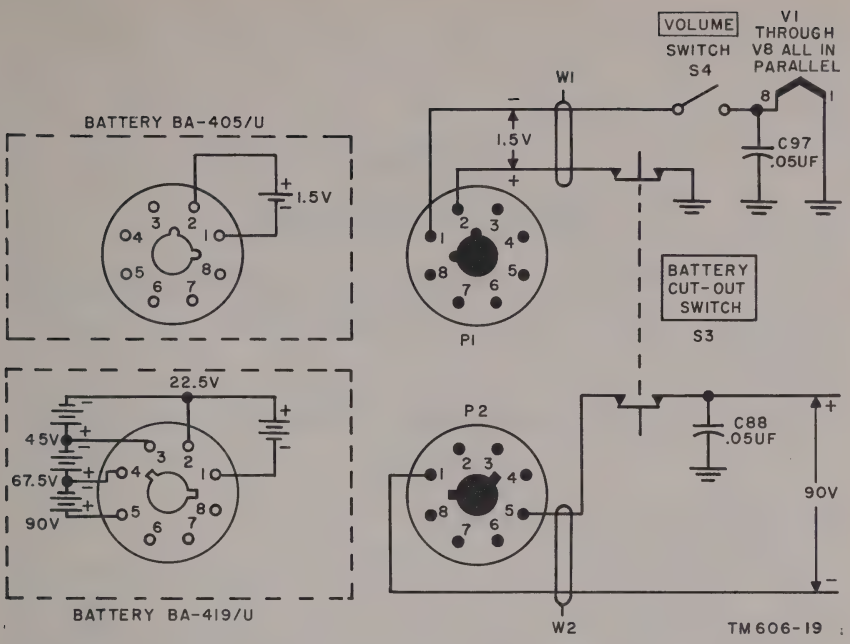


Figure 18. Power supply circuits.

applied to diode detector V6, where they are mixed to produce the audio beat signal.

c. Plate voltage for bfo oscillator V8 is applied through the primary winding of T5. Screen voltage is applied by direct connection of the screen to the B+ supply through B.F.O.-PITCH switch S2. Capacitor C47B bypasses rf around the B+ supply. Capacitor C47A bypasses rf around the filament supply.

50. Power Supplies

(fig. 18)

a. The receiver uses Battery BA–419/U for its B+ supply and Battery BA–405/U for its filament and bias supply. Battery BA–419/U supplies 90 volts to the receiver through plug P2 and battery cable W2. Battery BA–405/U supplies 1.5 volts through plug P1 and battery cable W1. Plugs P1 and P2 are keyed to the battery receptacles to prevent incorrect connection of the cables.

a. Battery voltages are supplied to the receiver through BATTERY CUT-OUT SWITCH S3. This switch is closed only when the carrying case cover is removed. The −1.5-volt filament supply is also connected through power switch S4 (on the VOLUME control), which turns on the receiver filaments. Bypass capacitors C88 and C97 bypass rf from the B+ and filament supplies, respectively.

CHAPTER 5

FIELD MAINTENANCE

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited away by the tools and test equipment available and the skill of the repairman.

Section I. TROUBLESHOOTING AT FIELD MAINTENANCE LEVEL

51. Troubleshooting Procedures

The first step in servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to the major component responsible for the abnormal operation of the set. The second step is to localize the fault. Localization means tracing the fault to the defective circuit or stage responsible for the abnormal condition. The third step, isolation, means to trace or isolate the fault to a particular part such as a resistor or capacitor. Some faults, such as burned-out resistors and shorted transformers, often can be located by sight, smell, and hearing. The majority of faults, however, must be located by checking voltage and resistance.

a. Sectionalization, Localization, and Isolation. One or more of the tests listed in (1) through (6) below may be used to sectionalize, localize, or isolate the source of trouble. To be effective, the procedure should be followed in the order given. First, sectionalize the trouble to the particular component such as the headset, receiver, or antenna. Then, localize the trouble to a single stage or circuit, where the trouble may be isolated by appropriate voltage, resistance, and continuity measurements. As symptoms of the trouble are noticed throughout the procedure, refer to the troubleshooting chart (par. 57*c*). The trouble symptoms and causes listed in this chart may aid considerably in determining the trouble.

(1) *Visual inspection.* The purpose of visual inspection (par. 37) is to locate any visible trouble. Through this inspection alone, the repairman may frequently discover the trouble, or determine the stage in which the trouble exists. This inspection is valuable in avoiding additional damage to the equipment that might occur through improper servicing methods, and in forestalling future failures.

(2) *Input resistance measurements.* These measurements (par. 55) prevent further damage to the equipment from possible short circuits. They also give an indication of the condition of the power circuits. Short circuit tests should be made before applying power to the receiver. If no short circuits exist, proceed with the operational test.

(3) *Operational test.* The operational test (par. 56) is important because it frequently indicates the general location of trouble. In many instances, the information gained will determine the exact nature of the fault.

(4) *Troubleshooting chart.* The trouble symptoms, causes, and corrections, listed in this chart (par. 57*c*) will aid greatly in localizing trouble. The chart should be used together with the other tests of the troubleshooting procedure.

(5) *Signal substitution.* The principal advantage of the signal substitution method (par. 59 and 60) is that it enables the repairman to localize a trouble to a stage when the general location of the trouble is not immediately evident from the above tests.

(6) *Stage gain charts.* These charts (par. 61) can be used to localize troubles that are hard to find by other methods.

b. Intermittents. An *intermittent* is a trouble that is not always present. It appears and disappears at irregular intervals. Sometimes therefore, it is very difficult to repair this type of trouble. In all tests the possibility of intermittents should not be overlooked. If this type of trouble exists, it often may be made to appear by tapping or jarring the set. It is possible that the trouble is not in the receiver itself but in the installation, or it may be due to external conditions. In this event, check the installation.

52. Troubleshooting Data

Take advantage of the material supplied in this manual. It will help in the rapid location of faults. Consult the following troubleshooting data:

Figure No.	Paragraph No.	Description
19	------	Tube socket voltage and resistance diagram.
20	------	Front view of chassis.
21	------	Rear view of chassis.
22	------	Bottom rear view of chassis.
24	------	Resistor color codes.
25	------	Capacitor color codes.
26	------	Radio Receiver R–104/TRR–8, schematic diagram.
58	------	Dc resistance of transformers and coils.

53. Test Equipment Required for Troubleshooting

The test equipment required for troubleshooting Radio Receiver R–104/TRR–8 is listed below. The technical manuals associated with the test equipment are listed. Two signal generators are necessary to cover the entire frequency range of the receiver. RF Signal Generator Set AN/URM–25C is used for the low end of the receiver frequency range and Signal Generator TS–497B/URR is used for the high end.

Test equipment	Technical manual
Electronic Multimeter TS–505/U	TM 11–5511
Tube Tester TV–2/U or Electron Tube Test Set TV–7/U	TM 11–5083
RF Signal Generator Set AN/URM–25C	TM 11–5551C
Signal Generator TS–497B/URR	TM 11–5030A

54. General Precautions

Whenever the radio set is serviced, observe the following precautions very carefully:

a. Remove the nine binder-head screws along the outer edges of the receiver front panel before attempting to pull the receiver out of its carrying case.

b. Careless replacement of parts often causes new faults. Note the following:

(1) Before a part is unsoldered, check the position of the leads. If the part, such as a transformer, has a number of connections, tag each lead to show the proper point of connection.

(2) Be careful not to damage other leads by pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the set. They may cause short circuits.

(4) A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints because a poorly soldered point is one of the most difficult faults to find.

c. When a part is replaced in an rf or if. circuit, it must be placed exactly as the original part was placed. A part which has the same electrical value but different physical size may cause trouble in hf circuits. Give careful attention to proper grounding when replacing a part. Use the same ground used in the original wiring. Failure to observe these precautions may result in decreased output or possibly in spurious oscillation of the circuit.

d. Do not disturb the adjustment of the transformer cores and trimmers in the antenna tuning circuit and the trimmers in the rf and if. stages of the receiver.

55. Checking Filament and B+ Circuits for Shorts

Trouble within the receiver often may be detected by checking the resistance of the high-voltage circuits before applying power to the equipment. Perform the procedure below before attempting to put the receiver in operation.

a. Disconnect the battery cables from the batteries.

b. Remove all tubes from their sockets.

c. Turn the VOLUME control to its extreme clockwise position.

d. Pull out the B. F. O.-PITCH control.

e. With an ohmmeter set to a suitable range, measure the resistance between pin 2 of each tube socket (XV1 through XV8) and the chassis. It should be at least 10 megohms. A lower resistance reading indicates a shorted or leaky bypass capacitor in one of the plate or screen grid circuits or a short in the wiring of one of the plate or screen grid circuits.

f. With the ohmmeter set to a suitable range, measure the resistance between pin 8 of each tube socket and the chassis. It should be 1.3 megohms. A zero or low reading indicates a short in the wiring of the receiver filament circuit or a shorted bypass capacitor in the filament circuit.

56. Operational Test

Perform the visual inspections indicated in paragraph 37. Operate the equipment as instructed in the equipment performance check list (par. 39). The visual inspections and the equipment performance check list are useful because they frequently reveal the general location of trouble. Check the receiver for smoke and for the odor of burned or overheated parts.

57. Troubleshooting Chart

The chart in *c* below, lists the symptoms of various troubles and the possible causes. The chart also indicates when the trouble is in the audio, if., or rf stage of the receiver. The signal substitution tests in paragraph 60 can then be used. Once the trouble has been localized to a stage or circuit, a tube check and voltage and resistance measurements ordinarily should be sufficient to isolate the defective part.

a. All voltage and resistance readings should be taken with the common lead of Electronic Multimeter TS–505/U (or equal) connected to the receiver chassis, the positive lead connected to the point being measured, and the meter set to a suitable range. Resistance measurements should be taken with the batteries disconnected from the receiver.

b. Voltage and resistance tests are helpful in isolating a defective component when the trouble has been localized to a particular stage. The procedure outlined below describes a method of using voltage,

resistance, and tube checks to isolate the defective component in a faulty stage or circuit.

(1) Test the tube in the suspected stage. This can be done by using a tube tester or by substituting a similar tube known to be in normal operating condition.

(2) Take voltage measurements at the tube socket in the affected stage and compare them to the normal readings indicated in figure 19.

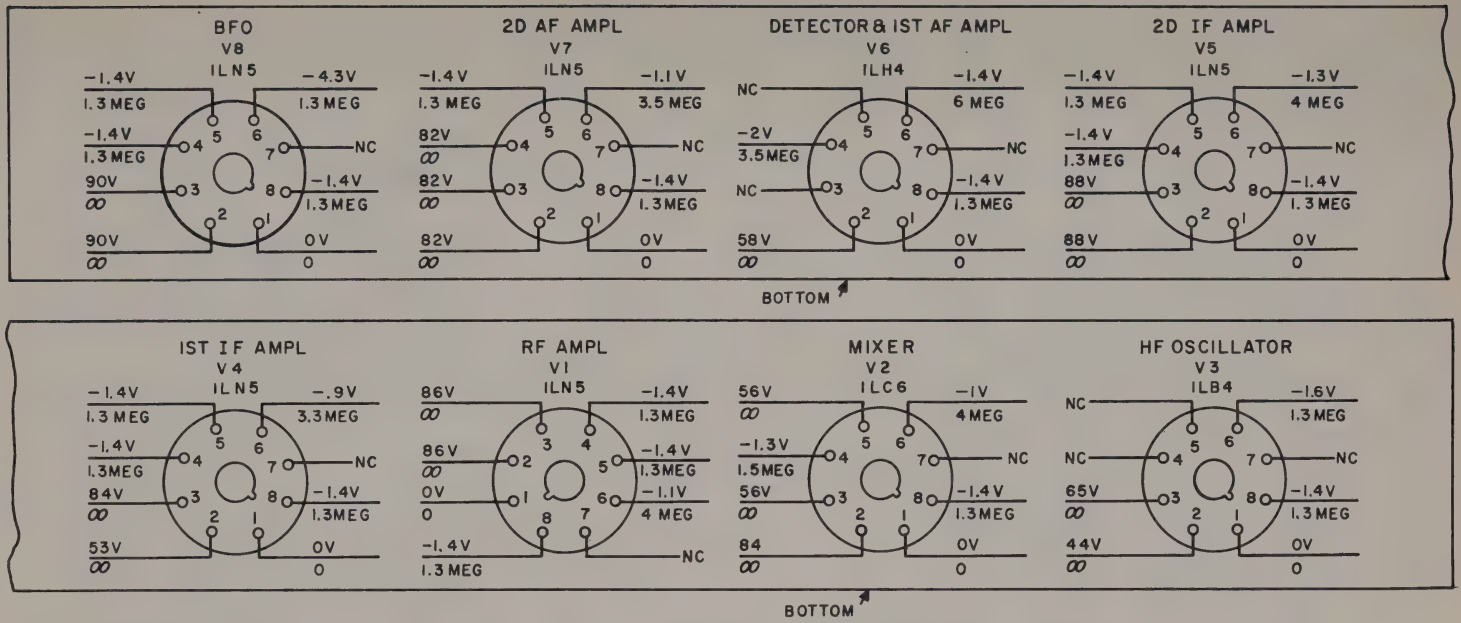
(3) If one or more voltage readings do not agree with those in the voltage and resistance diagram, take resistance measurements to locate open or shorted circuits or defective components. Very low resistance readings, as compared to those of figure 19, generally indicate shorted capacitors or shorted wiring. Very high resistances generally indicate defective or open resistors, coils, or circuits. Refer to paragraph 58 for the dc resistances of coils and transformers.

c. The following troubleshooting chart is supplied as an aid in locating trouble in the receiver.

Symptom	Probable trouble	Correction
1. No receiver output	BATTERY CUT-OUT SWITCH jammed.	Manually operate switch to loosen. Replace if defective.
	Cord plug not fully inserted in HEADSETS jack.	Push in cord plug.
	HEADSETS jack dirty or broken.	Plug cord into the other jack. If output is present, repair, clean, or replace defective HEADSETS jack.
	Open circuit in cord or headset.	Replace cord or headset.
	Weak batteries	Replace batteries.
	Defective tube	Check all tubes and replace defective tube.
	Faulty audio stage	Use signal substitution tests (par. 59 and 60) to locate faulty stage. Make voltage and resistance measurements to locate defective part.
2. No signal, only noise heard in headset when volume in increased.	Defective hf oscillator V3, rf amplifier V1, or mixer V2.	Set BAND SWITCH to band 8. If receiver operates, rf amplifier V1 is faulty. Otherwise use signal substitution tests (par. 59 and 60) to locate faulty stage. Make voltage and resistance measurements to locate defective part.

Symptom	Probable trouble	Correction
3. Signals weak on all bands. VOLUME control at maximum.	Low B+ and filament voltages because of weak batteries.	Check batteries and replace weak batteries.
	Weak tubes.	Check tubes for low emission. Replace weak tubes.
	Poor antenna installation.	Check Antenna AN–45–H to see that it is fully extended. Check auxiliary antenna for proper installation (par. 16).
	Open if transformer T1.	Make resistance measurements. Replace if defective.
4. Signal weak only on bands 1, 2, and 3.	Poor or no auxiliary antenna installation.	Check or install auxiliary antenna (par. 16).
5. Signals weak only on bands 1, 3, 4, and 5 or only on bands 2, 6, 7, and 8.	Open if transformer.	If signals are weak on bands 1, 3, 4, and 5, check resistance of T11 and T12. On bands 2, 6, 7, and 8, check resistance of T16 and T17. Replace defective if transformer.
6. Weak or no signal on only one band.	Tuned circuit for particular band in antenna, rf amplifier, or hf oscillator circuit defective or misalined.	Check alinement and tuned circuit for the particular band in antenna, rf amplifier, and hf oscillator circuits (par. 64–67). Aline tuned circuit or replace defective component.
7. Voice signals received but no audio signal heard when tuned to a cw signal.	Faulty bfo V8.	Make voltage and resistance measurements to locate defective component.
	Bfo misalined.	Check alinement of bfo (par. 68). Realine if necessary.
	Shorted B.F.O.-PITCH control C35 or trimmer C34.	Replace defective capacitor.
	B.F.O.-PITCH control switch S2 open.	Check continuity of switch with control pulled out. Repair or replace, if defective.
8. Distorted receiver output.	Faulty audio stage.	Use signal substitution tests (pars. 59 and 60) to locate faulty stage. Make voltage and resistance measurements to locate defective part.
	Incorrect grid bias on audio stage.	Check grid circuits for open or shorted resistors and leaky capacitors.
	Defective headset.	Replace headset.

Symptom	Probable trouble	Correction
9. Oscillation, whistling, and squeals in receiver output as receiver is tuned.	Faulty rf amplifier V1, mixer V2, hf oscillator V3, or if amplifier V4 or V5.	Use signal substitution tests (par. 60) to locate faulty stage. Make voltage and resistance measurements to locate defective part.
	Defective bypass capacitor.	Check capacitors by momentarily shunting these capacitors with others of equal capacity. Replace defective capacitors.
10. Oscillation, whistling, and squeals in receiver output when volume is increased.	Faulty if amplifier V4 or V5.	See symptom 9 above.
11. Loud static and noise in receiver ouput as receiver is tuned.	Shorted TUNING capacitor C39 plates.	Bend plates to normal position or replace if defective. If plates are badly bent or capacitor is replaced, the receiver must be realined (par. 64 through 68).
12. No B. F. O.-PITCH control during cw reception.	Lead from B. F. O.-PITCH capacitor C35 disconnected.	Replace lead.
13. No receiver output until VOLUME control is advanced, then output suddenly appears.	Open VOLUME control R23.	Check resistance of VOLUME control and replace, if defective.
14. Loud distorted signal in receiver output. VOLUME control does not have any effect.	Shorted VOLUME control.	Check resistance of VOLUME control and replace, if defective.
15. Intermittent operation. Abrupt cutting in and out of signal.	Defective tube. Resistor or capacitor opens intermittently. Loose wiring.	With an insulated prod, gently tap and slightly move all tubes, resistors, capacitors, and soldered connections to locate loose elements in tubes or loose connections to any component.



NOTES:

1. BAND SWITCH ON BAND 1.
2. TUNING CONTROL AT HIGH FREQUENCY END OF BAND.
3. RESISTANCE MEASURED TO GROUND WITH A 20,000 OHM-PER-VOLT METER, WITH ALL TUBES REMOVED, BATTERIES DISCONNECTED, POWER SWITCH OFF, AND B.F.O.–PITCH SWITCH PUSHED IN.
4. VOLTAGE MEASURED TO GROUND WITH A 20,000 OHM-PER-VOLT METER, WITH VOLUME CONTROL FULLY CLOCKWISE AND B.F.O.–PITCH SWITCH PUSHED IN (EXCEPT FOR V8, SWITCH PULLED OUT).
5. NC INDICATES NO CONNECTION.
6. VOLTAGE READINGS ABOVE LINE ARE DC. RESISTANCE READINGS BELOW LINE ARE IN OHMS.

TM 606-7

Figure 19. Tube socket voltage and resistance diagram.

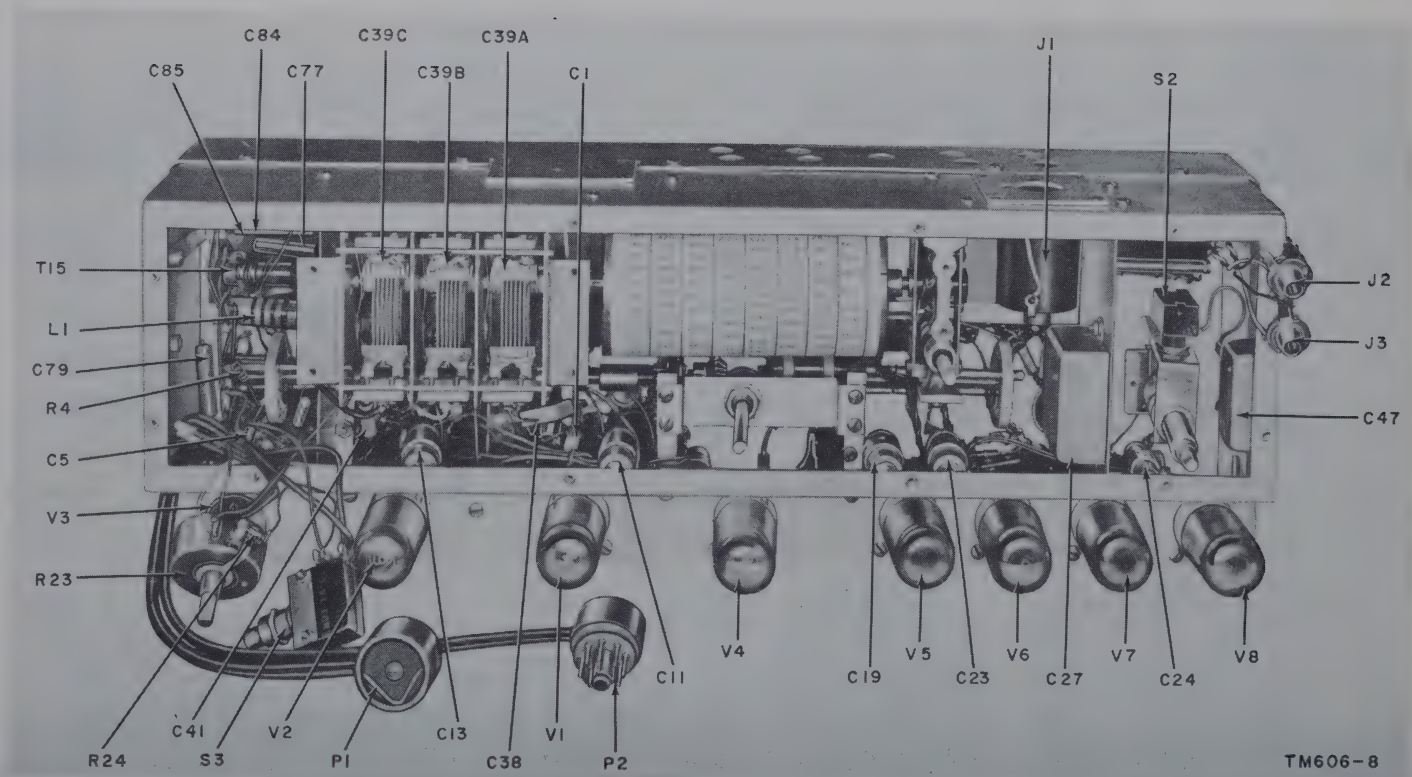


Figure 20. Front view of chassis.

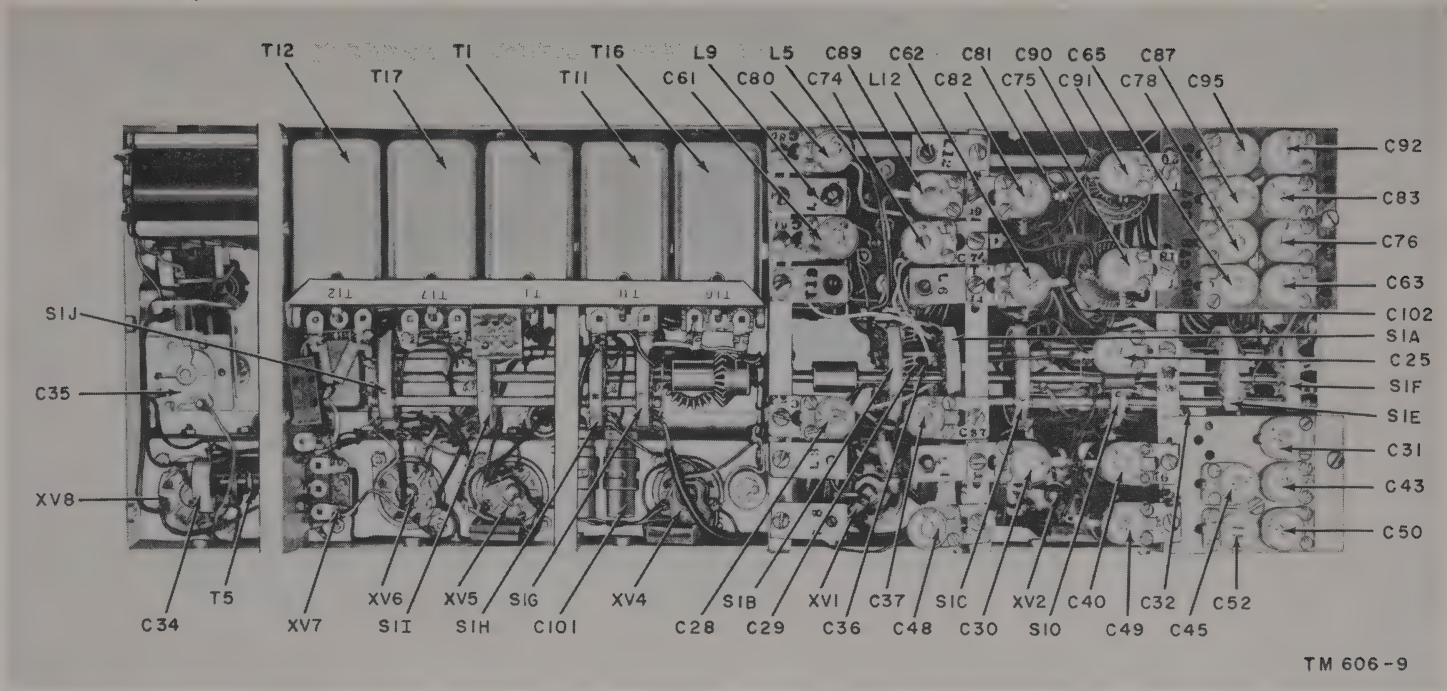


Figure 21. Rear view of chassis.

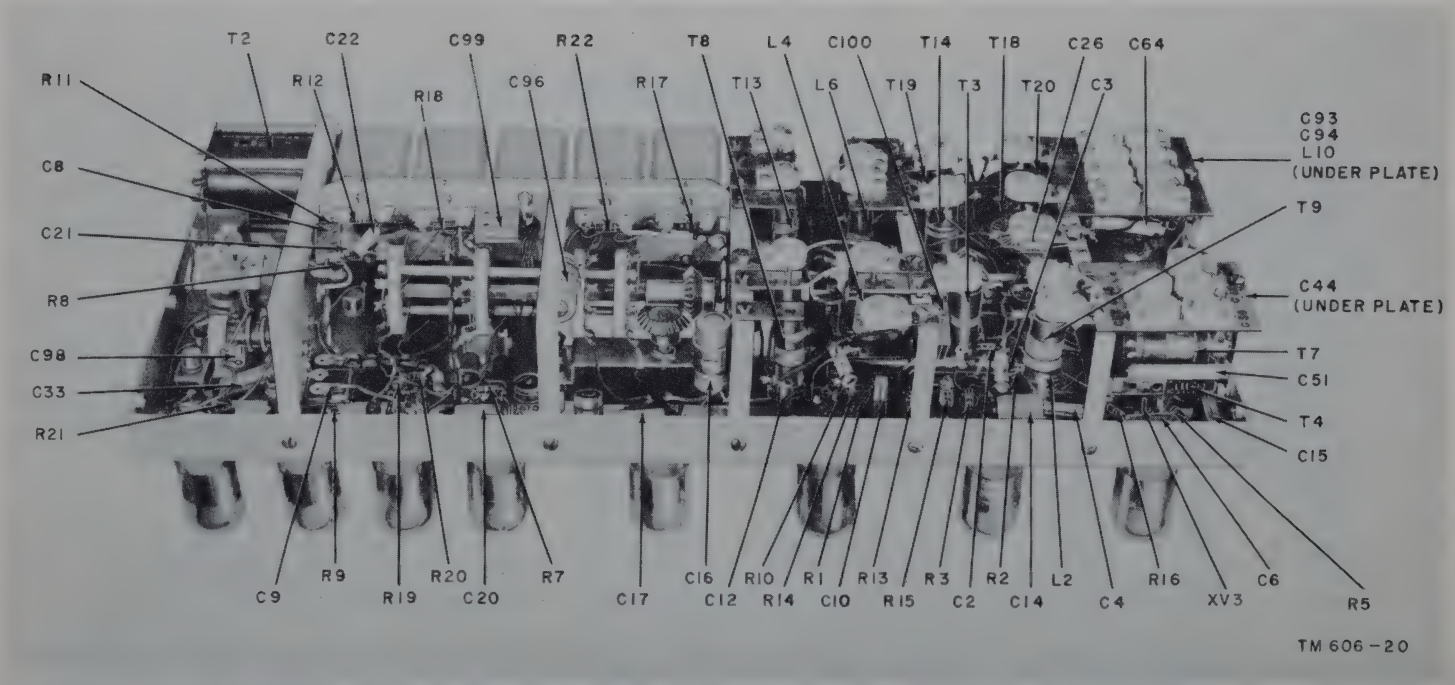


Figure 22. Bottom-rear view of chassis.

58. Dc Resistances of Transformers and Coils

The dc resistances of the transformer windings and coils in the receiver are listed below:

Transformer of coil	Terminals	Ohms
L1		10
L2		Less than .1
L3		Less than .1
L4		Less than .1
L5A		25
L5B		60
L5C		140
L6		12
L9		29
L10A		4
L10B		8
L12		42
T1	RED to BLU	8,200
	GRN to BLK	Infinite
T2	1 to 2	1,200
	3 to 4	60
T3	Primary	2.5
	Secondary	Less than .1
T4	Primary	Less than .1
	Secondary (RED-BLU)	.5
T5	Primary	10
	Secondary (RED-BLU)	23
T6	Primary	6
	Secondary	Less than .1
T7A	Primary	Less than .1
	Secondary	.25
T7B	Primary	1.25
	Secondary	.25
T8	Primary	5.
	Secondary	2
T9	Primary	27
	Secondary	1
T11	Primary	9.5
	Secondary	9.5

Transformer of coil	Terminals	Ohms
T12	Primary	9.5
	Secondary	9.5
T13	Primary	17.5
	Secondary	4
T14	Primary	56
	Secondary	5
T15A	Primary	1
	Secondary	3
T15B		5.5
T16	Primary	10
	Secondary	10
T17	Primary	10
	Secondary	10
T18	Primary	136
	Secondary	12
T19	Primary	148
	Secondary	40
T20	Primary	150
	Secondary	110

59. General Signal Substitution Procedure

a. Signal substitution (par. 60) consists of injecting a signal into each stage of the receiver to test that stage and all following stages. The procedure requires a signal generator as a source of audio, if., and rf signals. The output stage is tested first and then each stage, in order, back to the receiver input. While working back from the output stages to the input stages, decrease the signal generator output as much as possible to avoid overloading the receiver. When the trouble is localized in a particular stage, test the tube if necessary. Then measure the voltage and resistance at the tube socket pins and across the various individual components (par. 57*b*). Use Electronic Multimeter TS–505/U for voltage and resistance measurements. When testing tubes, remove only one tube at a time. If a tube is not defective, replace it in its socket before removing another tube. Isolate and correct each trouble before proceeding with the next step.

b. Two signal generators are used for the entire receiver frequency range. RF Signal Generator Set AN/URM–25C (or equal) should be used as the signal source for the if. and the lower half of the receiver

frequency range. Signal Generator TS–497B/URR (or equal) should be used as the signal source for the high end of the receiver frequency range. Connect the common (ground) lead of the signal generator to the receiver chassis. Connect the other signal generator lead to the proper test point through a .05-microfarad (μf) capacitor

60. Signal Substitution Test

While performing each of the tests given in *a*, *b*, and *c* below, remember the instructions given in paragraph 59.

a. Af Tests.

(1) *Plate of second af amplifier.* Connect a 1,000-cps signal to pin 2 of tube V7. Plug the headset into one of the HEADSETS jacks and listen for the signal. The volume will be low. If no signal is heard, check the dc resistance of transformer T2 (par. 58), the headset connections, and capacitors C24 and C27 (fig. 20).

(2) *Grid of second af amplifier.* Connect the 1,000-cps signal to pin 6 of tube V7. The output heard in the headset should be louder than that heard when the signal was connected to the plate of V7. If it is weak or if there is no output, check tube V7. It may also be necessary to make voltage and resistance measurements at the tube socket (fig. 19) to isolate defective components.

(3) *Plate of first af amplifier.* Connect the 1,000-cps signal to pin 2 of tube V6 and listen for the output in the headset. The output should be about as loud as it was when the signal was connected to pin 6 of tube V7. If there is no output, check capacitor C9 (fig. 22) by temporarily connecting a 2,000-micromicrofarad ($\mu\mu$f) capacitor across it.

(4) *Grid of first af amplifier.* Connect the 1,000-cps audio signal to pin 6 of tube V6. The output should be louder than it was when the signal was applied to the plate. If the signal is weak or is not present, test V6 and make voltage and resistance measurements at the tube socket (fig. 19). Inspect the wires for breaks and the connections for cold solder joints.

b. If. Tests. Push in the B. F. O.-PITCH control and advance the VOLUME control to its maximum clockwise position. Set the BAND SWITCH to band 1 (.100–.220 M. C.).

(1) *Plate of detector.* Connect a 455-kc signal, modulated 30 percent with a 1,000-cps audio signal, to pin 4 of tube V6. A loud tone should be heard in the headset. If the tone is weak or if there is none, check the parts in the detector load circuit by measuring the resistance at pins 4 and 6 (fig. 19).

Note. When checking trouble in all circuits that require the signal to go through switches, always check the switch contacts carefully.

(2) *Plate of second if. amplifier.* Apply the modulated 455-kc signal to pin 2 of tube V5. A loud signal should be heard in the headset. If the signal is weak or is not present, check the dc resistance of T12 (par. 58) and the if. alinement (par. 66). Switch to band 2 (.220–.500 M. C.), apply a modulated 910-kc signal to plate pin 2, and listen for a loud signal. If the signal is weak or is not present, check the dc resistance of T17 (par. 58) and the if. alinement (par. 66).

(3) *Grid of second if. amplifier.* With the BAND SWITCH set at band 2, apply the modulated 910-kc signal to pin 6 of tube V5. A somewhat louder signal should now be heard in the headset. If the signal is weak or is not present, check the tube and make voltage and resistance measurements at the tube socket (fig. 19). A positive voltage at the grid (pin 6) indicates leaky capacitor C7 (in transformer T1) (fig. 21).

(4) *Plate of first if. amplifier.* Apply the modulated 910-kc signal to pin 2 of tube V4. A loud signal should be heard in the headset. If the signal is weak or is not present, measure the resistance of the primary of T1 (par. 58) and check the if. alinement (par. 66).

(5) *Grid of first if. amplifier.* Apply the modulated 910-kc signal to pin 6 of tube V4. A louder signal should be heard in the headset. Check the tube if the signal is weak or if there is no signal. Make voltage and resistance measurements at the tube socket (fig. 19). Repeat the test with a modulated 455-kc signal at pin 6 with the BAND SWITCH set to band 1. The output heard in the headset should be less than that heard when on band 2.

(6) *Plate of mixer.* With the BAND SWITCH still set at band 1, connect the modulated 455-kc signal to pin 2 of tube V2. A loud signal should be heard in the headset. If the signal is weak or is not present, check the dc resistance of T11 (par. 58) and the if. alinement (par. 66). Set the BAND SWITCH to band 2, connect a modulated 910-kc signal to pin 2 of V2, and listen for a loud signal in the headset. If the signal is weak or is not present, check the dc resistance of T16 (par. 58) and the if. alinement (par. 66). Pull out the B. F. O.-PITCH control and connect an unmodulated 910-kc signal to pin 2 of tube V2. Rotate this control clockwise and counterclockwise and listen for a signal that increases and decreases in pitch on either side of a null. If there is no output, check tube V8 and make voltage and resistance measurements at that tube socket (fig. 19). It may be necessary to readjust C34 (par. 68 and fig. 21).

c. Rf Tests.

(1) *Grid of mixer.* Apply a 30-mc signal, modulated 30 percent at 1,000 cps, to pin 6 of tube V2. Set the BAND SWITCH to band 7 (13.4–31.0 M. C.) and adjust the TUNING control for a loud output. If there is little or no output, tube V2 or V3 is probably at fault. Check the tubes and make voltage and resistance measurements in the two circuits. Be sure that the hf oscillator tuned circuit for band 7 is properly alined (par. 67*c*). Repeat the procedure and apply a signal at a frequency in each of the seven other bands to pin 6 of V2.

(2) *Plate of rf amplifier.* Connect the modulated 30-mc signal to pin 2 of tube V1. Set the BAND SWITCH to band 7 and adjust the TUNING control for a loud signal. No signal or a very weak one indicates a faulty mixer input circuit. Check the dc resistance of T3 (par. 58) and the alinement of the rf amplifier tuned circuit for band 7 (par. 67). Repeat the procedure for bands 1 through 6; use an input frequency within the range of each band checked.

(3) *Grid of rf amplifier.* Connect the modulated 30-mc signal to pin 6 of V1. Set the BAND SWITCH to band 7, and adjust the TUNING control for a loud signal in the headset. If the signal is weak or is not present, check V1 and make voltage and resistance measurements at the tube socket.

(4) *Antenna receptacle J1.* Connect the modulated 30-mc signal to antenna receptacle J1. Set the BAND SWITCH to band 7 and adjust the TUNING control for a loud signal. No signal or a weak one indicates a faulty antenna tuning circuit. Check the dc resistance of L3 (par. 58) and the alinement of the antenna tuning circuit for band 7 (par. 67). Repeat the procedure, for bands 1 through 6; use an input frequency within the range of each of the seven other bands.

61. Stage Gain Chart

The stage gain chart in *b* below lists the input voltages required at the input of the if. stages of the receiver to produce a receiver output of 1 milliwatt (mw). Localize the defective stage by comparing the value of the signal voltage actually necessary at the input of the stage to produce a 1-mw output with that shown in the chart. Weak stages can be detected in this way. Use the sensitivity chart (par. 71) to check the overall gain of the receiver.

a. Test Procedure. Use the chart in *b* below and apply the following procedure to test the gain of the if. stages.

(1) Connect Electronic Multimeter TS–505/U across one of the HEADSETS jacks. Use this meter as an output meter.

(2) Connect a 247-ohm resistor across the input of the meter.
(3) Turn the VOLUME control to the maximum clockwise position.
(4) Set the BAND SWITCH as indicated in the band column.
(5) Adjust the signal generator to the frequency indicated in the signal generator frequency column. Modulate the signal 30 percent with a 400-cycle audio signal.
(6) Connect the signal generator output through a 50-$\mu\mu$f capacitor to the tube socket indicated in the signal generator output connection column.
(7) Adjust the output level of the signal generator to produce a 1-mw receiver output (.5 volt on the meter). Note this value and compare it to the value listed in the signal generator output column. If it is equal to, or less than, the value shown in the chart, the gain of the stage may be considered satisfactory.

b. Stage Gain Chart.

Band	Signal generator frequency (kc)	Signal generator output connection (through a 50-$\mu\mu$f capacitor)	Signal generator output (microvolts)
1	455	Pin 6 of V2	48
1	455	Pin 6 of V4	680
1	455	Pin 6 of V5	4, 400
2	910	Pin 6 of V2	38
2	910	Pin 6 of V4	800
2	910	Pin 6 of V5	5, 300

Section II. REPAIRS

62. Replacement of Parts

Most of the parts in Radio Receiver R–104/TRR–8 are readily accessible and easily replaced. When the BAND SWITCH requires replacement, mark the wires that are connected to the switch with tags to avoid wrong connections when the new switch is installed. Follow this practice whenever replacement requires disconnecting numerous wires. Careless replacement of parts often causes new faults. Refer to paragraph 54 for general precautions to be followed when replacing parts.

63. Refinishing

Instructions for refinishing badly marred panels are given in TM 9–2851.

Section III. ALINEMENT PROCEDURES

64. Test Equipment Used for Alinement and Adjustment

a. Signal Generator. Two signal generators are used to cover the entire receiver frequency range when alining the receiver. Both generators are capable of producing modulated rf signals. The two signal generators must be calibrated accurately to calibrate the receiver dial. RF Signal Generator Set AN/URM–25C (or equal) is used to aline the low end of the receiver frequency range and Signal Generator TS–497B/URR is used to aline the high end.

b. Output Meter. Electronic Multimeter TS–505/U is used as an output meter. A 247-ohm resistor must be connected across the meter input to match the impedance offered by the headset in operation.

c. Additional Equipment. The following additional equipment is necessary to aline the receiver:

1 alinement tool
1 capacitor, 50 $\mu\mu$f
1 resistor, 247 ohms, 1 watt, JAN type RC30BF247J

65. Preliminary Alinement Procedures

a. Turn on the signal generator and allow it to reach a stable operating temperature (approximately 15 minutes is required). Be sure that the signal generator is accurately calibrated. Refer to TM 11–5551C (for RF Signal Generator Set AN/URM–25C) or to TM 11–5030A (for Signal Generator TS–497B/URR) for calibration instructions.

b. Remove the BATTERY COMPARTMENT and SPARE TUBE COMPARTMENT cover below the receiver by loosening the fasteners on the sides of the cover.

c. Disconnect the power cables from the batteries and pull out the batteries.

d. Remove the screws in the metal strip that support the receiver chassis in the carrying case. Press down the lower portion of the receiver chassis while grasping the top portion as soon as it is freed by the pressure on the bottom. The downward pressure should be in the direction of the rear of the case and not toward the outside. Pull the receiver out of the case at a slight angle, with the top portion leading the lower portion.

e. Connect Electronic Multimeter TS–505/U across one of the HEADSETS jacks and connect a 247-ohm resistor across the meter input.

f. Connect the receiver power cables to the batteries and allow the receiver to warm up for about 15 minutes.

66. If. Alinement

Perform the preliminary procedures described in paragraph 65.

a. Remove the rear cover of the receiver by taking out the screws that fasten it to the chassis.

b. Tune the receiver to a frequency in the low end of band 2 and turn the VOLUME control maximum clockwise.

c. Set the signal generator to 910 kc with 30 percent modulation at 400 cps.

d. Connect the test lead of the signal generator output to pin 6 of second if. amplifier V5 through the 50-$\mu\mu$f capacitor. Connect the signal generator ground lead to the receiver chassis.

e. Adjust the signal generator attenuator for a reading of 1 mw (.5 volt alternating current (ac)) on the output meter connected to the receiver.

Note. As alinement progresses, it may be necessary to readjust the attenuation to keep the output meter reading on scale.

f. With the alinement tool, adjust C71A and C71B (fig. 23) for a maximum reading on the output meter.

g. Connect the test lead of the signal generator to pin 6 of first if. amplifier V4 through the 50-$\mu\mu$f capacitor.

h. With the alinement tool, adjust C18 (fig. 23) for a maximum reading on the output meter.

i. Connect the test lead of the signal generator to pin 6 of mixer V2 through the 50-$\mu\mu$f capacitor.

j. With the alinement tool, adjust C67A and C67B (fig. 23) for a maximum reading on the output meter.

k. With the test lead on pin 6 of V2, recheck the settings of all if. trimmers for maximum reading on the output meter.

l. Adjust the signal generator for a 455-kc output frequency with 30 percent modulation at 400 cycles. Aline the 455-kc circuits by setting the receiver BAND SWITCH at band 1 and repeating the procedure described in *d* through *k* above. Adjust C58A and C58B instead of C71A and C71B as stated in *f* above. Adjust C54A and C54B instead of C67A and C67B as stated in *j* above.

67. Rf Alinement

Perform the preliminary procedures in paragraph 65.

a. Preliminary Adjustments. For rf alinement on each of the eight bands of the receiver, proceed as follows:

(1) Be sure that the rear cover is on the receiver.
(2) Push in the B. F. O.-PITCH control.
(3) Adjust the signal generator for an output frequency of .100 mc with 30 percent modulation at 400 cycles.
(4) Connect the test lead of the signal generator output to the antenna input terminal through the 50-$\mu\mu$f capacitor. Con-

nect the ground lead of the signal generator to the receiver chassis.

(5) Set the BAND SWITCH to band 1. Adjust the TUNING control to produce a maximum reading on the output meter. When the maximum reading is obtained on the output meter, the tuning dial should indicate .100 mc. If any major difference is noted between the receiver dial setting and the signal generator dial setting, hf oscillator alinement (*b* and *c* below) is necessary.

(6) Change the frequency of the signal generator to .160 mc.

(7) Tune the receiver to .160 mc on band 1, by adjusting the TUNING control and by observing when the setting of the TUNING control produces a maximum reading on the output meter. Note if there is any major difference between the receiver dial setting and the signal generator dial setting.

(8) Change the signal generator frequency to .205 mc.

(9) Tune the receiver to .205 mc on band 1, by adjusting the TUNING control and observing when the setting of the TUNING control produces a maximum reading on the output meter. Note if there is any major difference between the receiver dial setting and the signal generator dial setting.

(10) Repeat the procedure in (5) through (9) above for a low, middle, and high frequency in bands 2 through 8. On each band, note whether there is a major difference between the receiver dial setting and the signal generator dial setting.

b. Band 1 Alinement.

(1) Set the signal generator to .205 mc with 30 percent modulation at 400 cycles and connect it as instructed in *a*(4) above.

(2) Set the BAND SWITCH to band 1 and tune the receiver to .205 mc.

(3) Adjust hf oscillator trimmer C92 (fig. 23) with the alinement tool for a maximum reading on the output meter.

(4) Adjust mixer trimmer C91 in transformer T20 (fig. 23) with the alinement tool for maximum reading on the output meter.

(5) Adjust antenna trimmer C89 (fig. 23) with the alinement tool for a maximum reading on the output meter.

(6) Change the signal generator frequency to .100 mc.

(7) Adjust the TUNING control to tune the receiver to .100 mc.

(8) Adjust C95 (fig. 23) with the alinement tool for a maximum reading on the output meter.

(9) Adjust antenna coil L12 with the tuning wrench on the alinement tool for a maximum reading on the output meter.

(10) Repeat the procedure in (1) through (9) above until a maximum reading is obtained.

c. Bands 2 Through 8 Alinement.

(1) To aline the hf end of each band, set the signal generator to the higher of the two frequencies listed for that band in the receiver and signal generator frequency column of the chart in (2) below. Tune the receiver to this frequency. Adjust the hf oscillator trimmer capacitor listed in the hf oscillator adjustment column for that frequency. Then adjust the mixer and antenna circuit components listed for each frequency in the mixer adjustment and antenna adjustment columns, respectively. In each case, the adjustment is for a maximum reading on the output meter. Figure 23 indicates the location of all these adjustments.

(2) To aline the low-frequency end of the band, follow the same procedure as described in (1) above but use the lower of the two frequencies listed for each band in the chart below and make the adjustments listed for each frequency. The mixer is alined only at the hf end of each band. There is no low-frequency mixer adjustment. The hf oscillator and the mixer cannot be alined at the low-frequency end of band 7. The only adjustment necessary for band 8 is the mixer adjustment at the hf end of the band.

Band	Receiver and signal generator frequency (mc)	Hf oscillator adjustment	Mixer adjustment	Antenna adjustment
1	.100	C95	None	L12
	.205	C92	C91 (T20)	C89
2	.240	C87	None	L9
	.470	C83	C82 (T19)	C80
3	.540	C78	None	L6
	1.10	C76	C75 (T18)	C74
4	1.20	C65	None	T13
	2.40	C63	C62 (T14)	C61
5	2.70	C52	None	T8
	5 60	C50	C49 (T9)	C48
6	6.0	C45	None	L4
	13.0	C43	C40 (T6)	C37
7	14.0	None	None	L3
	28.0	C31	C30 (T3)	C28
8	65.0	None	C25	None

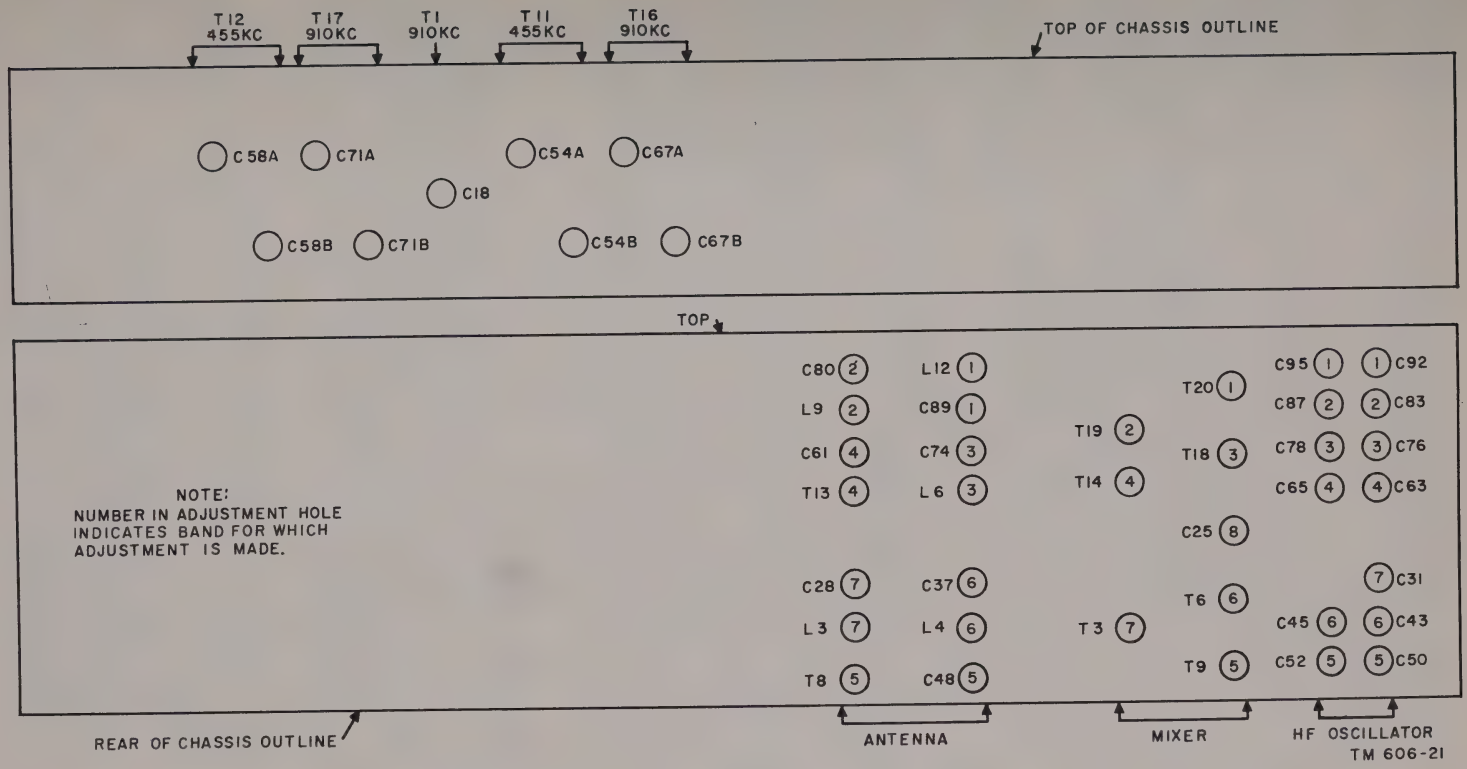


Figure 23. Location of alinement adjustment points.

(3) Repeat the alinement procedure given in (1) and (2) above until a maximum reading is obtained.

68. Bfo Alinement

The bfo must be alined if no tone is heard in the headset when the B. F. O.-PITCH control is pulled out and the receiver is tuned to a cw signal. To aline the bfo, proceed as follows:

a. Set the BAND SWITCH to band 1 and adjust the TUNING control to a frequency in the low-frequency end of the band.

b. Turn the VOLUME control to its maximum clockwise position; pull out the B. F. O.-PITCH control, and rotate it to its midposition.

c. Remove the receiver chassis rear cover.

d. Set the signal generator to 455 kc with no modulation.

e. Connect the test lead of the signal generator to pin 6 of mixer V2 through the 50-$\mu\mu$f capacitor and connect the ground lead to the receiver chassis.

f. Plug the headset into one of the HEADSETS jacks.

g. Replace the receiver chassis rear cover; allow clearance for the signal general test lead.

h. With the alinement tool, adjust C34 (fig. 21), on the left side of the receiver, to the zero beat point. (Audible signal in headset keeps getting lower in pitch until the signal no longer is heard. This is the zero beat point.)

i. Tune the receiver to a frequency in the hf end of band 2.

j. Set the signal generator to 910 kc with no modulation.

k. Check for the presence of a zero beat as obtained in *h* above.

Section IV. FINAL TESTING

69. General

This section is intended as a guide to be used in determining the quality of a repaired Radio Receiver R–104/TRR–8. The minimum test requirements in paragraphs 71 through 76 may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting these requirements will furnish uniformly satisfactory operation.

70. Test Equipment Required for Final Testing

a. The instruments needed for testing the repaired receiver are listed below:

1 RF Signal Generator Set AN/URM–25C.
1 Signal Generator TS–497B/URR.
1 Electronic Multimeter TS–505/U (used as an output meter).
1 capacitor, 50 $\mu\mu$f.
1 resistor, 247 ohms, 1 watt, JAN type RC30BF247J.

b. Both generators (*a* above) are necessary to cover the entire receiver frequency range. The term signal generator, as used in paragraphs 71 through 76, refers to either of the two generators. Use the one that is capable of producing the required signal frequency for the particular test.

71. Sensitivity Test

a. Preliminary Procedure.

(1) Connect the signal generator to antenna input jack J1 through a 50-$\mu\mu$f capacitor.
(2) Connect Electronic Multimeter TS–505/U (the output meter) across one of the HEADSETS jacks.
(3) Connect a 247-ohm resistor across the input of the meter.
(4) Turn the VOLUME control to its maximum clockwise position.

b. Test Procedures. Apply the following procedure for each of the frequencies listed in the chart in *c* below.

(1) Set the BAND SWITCH as indicated in the band column.
(2) Set the signal generator to the frequency listed in the frequency column.
(3) Modulate the signal generator rf signal 30 percent with a 400-cycle audio signal and set the output level of the signal generator to the value listed in the modulated input column for that frequency.
(4) The receiver output should be 1 mw as indicated by a reading of .5 volt on the output meter.
(5) Remove the modulation from the rf signal and set the output level of the signal generator as indicated in the cw input column.
(6) Turn on the bfo by pulling out the B. F. O.-PITCH control.
(7) The receiver output should be 1 mw as indicated by a reading of .5 volt on the output meter.

c. Sensitivity Chart.

Band	Frequency (mc)	Modulated input (uv)	CW input (uv)
1	.105	4.5	1.8
	.160	4.0	1.2
	.210	3.8	.9
2	.231	5.0	1.0
	.360	2.8	.7
	.475	2.0	.4
3	.525	2.2	.4
	.800	1.6	.1
	1.04	2.4	.3

Band	Frequency (mc)	Modulated input (uv)	CW input (uv)
4	1. 15	2. 1	. 4
	1. 85	2. 4	. 5
	2. 47	2. 5	. 2
5	2. 73	1. 5	. 2
	4. 30	2. 9	. 1
	5. 70	. 1	. 1
6	6. 09	2. 0	. 1
	9. 65	1. 4	. 2
	12. 85	1. 4	. 1
7	14. 07	3. 0	1. 0
	22. 2	2. 4	1. 0
	29. 45	1. 9	1. 0
8	31. 5	20. 0	3. 5
	47. 5	14. 0	2. 0
	61. 75	6. 0	2. 5

72. Selectivity Test

a. Perform the preliminary procedure described in paragraph 71*a*.

b. Modulate the signal generator 30 percent with a 400-cps signal.

c. Perform the following procedure with the signal generator set to each frequency in the test frequency column of the chart in (4) below. (No data is given in the chart for band 8 because the selectivity in this band is the same as that in band 7; therefore no selectivity test is required for band 8.)

(1) Set the signal generator output at 5 microvolts (μv).

(2) Adjust the VOLUME control for a 1-mw receiver output as indicated by a reading of .5 volt ac on the output meter. Do not change the position of the VOLUME control for the remainder of this test.

(3) Increase the signal generator output to 10 μv. Detune the signal generator below the test frequency until the output meter reading is again .5 volt. Note the signal generator frequency at which this reading is obtained. Now detune the signal generator above the test frequency until the output meter reading is again .5 volt. Note the signal generator frequency. The difference between the two signal generator frequencies at which the .5-volt output meter readings were obtained is the total bandwidth at the *two times down* level. This bandwidth must be as shown in the chart in (4) below.

(4) Perform the same procedure as in (3) above; apply signals

of 50 μv (10 times down), 500 μv (100 times down), and 5,000 μv (1,000 times down). The bandwidths should be as shown in the chart that follows:

Band	Test frequency (mc)	Total bandwidth ±15 percent (kc)			
		Two times down (10 uv)	10 times down (50 uv)	100 times down (500 uv)	1,000 times down (5,000 uv)
1	.150	3.4	7.6	14	21.3
2	.350	3.0	7.1	13	20
3	.750	6.8	13.6	24	37
4	1.8	6.0	13	24	36
5	3.6	7	14	27	45
6	8.0	12	25	46	81
7	26.0	13.5	30	54	89

73. Image Rejection Ratio

a. Preliminary Procedure.

(1) Connect the signal generator to antenna input jack J1 through a 50-μμf capacitor.

(2) Connect Electronic Multimeter TS–505/U (the output meter) across one of the HEADSETS jacks.

(3) Connect a 247-ohm resistor across the output of the meter.

(4) Turn on the receiver.

b. Test Procedure. Follow the procedure below for each of the frequencies listed in the chart in *c* below.

(1) Set the BAND SWITCH as indicated in the band column.

(2) Tune the signal generator and the receiver to the frequency indicated in the test frequency column. Modulate the signal generator rf signal 30 percent with a 400-cps signal.

(3) Set the output level of the signal generator at 10 uv for bands 1 through 7 and 5 uv for band 8 and adjust the VOLUME control for a .5-volt ac reading on the output meter (1-mw receiver output).

(4) Tune the signal generator to the image frequency of the test frequency to which the receiver is tuned as indicated in the image frequency column. (The image frequency is twice the if. plus the test frequency on bands 1 through 7 and twice the if. lower than the test frequency on band 8. The if. for bands 1, 3, 4, and 5 is 455 kc; for bands 2, 6, 7, and 8, the if. is 910 kc.)

(5) Readjust the output level of the signal generator to produce again a 1-mw receiver output (.5 volt on the meter). Do not change the position of the VOLUME control. The

signal generator output at this point should be at least the value shown in the image signal input column. The actual image rejection ratio is shown in the image rejection ratio column and is determined by dividing the signal generator output required to produce a 1-mw receiver output at the image frequency by the signal generator output required for a 1-mw output at the test frequency.

c. Image Rejection Ratio Chart.

Band	Test frequency (mc)	Test signal input (uv)	Image frequency (mc)	Image signal input (uv)	Image rejection ratio
1	.150	10	1.060	400,000	40,000:1
2	.350	10	2.170	330,000	33,000:1
3	.750	10	1.660	30,000	3,000:1
4	1.8	10	2.710	80,000	8,000:1
5	3.6	10	4.510	6,500	650:1
6	8.0	10	9.820	3,250	325:1
7	26.0	10	27.820	1,000	100:1
8	52.0	5	50.180	11	2.2:1

74. If. Rejection Ratio

Follow the procedure below for each of the frequencies listed in the chart in *f* below.

a. Connect the equipment as described in paragraph 73*a*.

b. Set the BAND SWITCH as indicated in the band column of the chart in *f* below.

c. Tune the signal generator and the receiver to the frequency indicated in the test frequency column. Modulate the signal generator rf signal 30 percent with a 400-cps signal.

d. Set the output level of the signal generator at 2 uv for bands 1 through 7 and 300 uv for band 8 and adjust the VOLUME control for a .5-volt reading on the output meter (1-mw receiver output).

e. Tune the signal generator to the if. frequency indicated for the band in the if. column of the chart.

f. Increase the output level of the signal generator to produce again a 1-mw receiver output (.5 volt on the meter). Do not change the position of the VOLUME control. The signal generator output at this point should be at least the value shown in the if. signal input column. The actual if. rejection ratio is shown in the if. rejection ratio column and is determined by dividing the signal generator output required to produce a 1-mw receiver output at the if. by the signal generator output required for a 1-mw output at the test frequency.

Band	Test frequency (mc)	Test signal input (uv)	If. (kc)	If. signal input (uv)	If. rejection ratio
1	.150	2	455	80, 000	40, 000:1
2	.350	2	910	14, 000	7, 000:1
3	.750	2	455	1, 500	750:1
4	1.8	2	455	1, 900	950:1
5	3.6	2	455	300, 000	150, 000:1
6	8.0	2	910	400, 000	200, 000:1
7	26.0	2	910	40, 000	20, 000:1
8	52.0	300	910	300, 000	1, 000:1

75. Calibration Accuracy

The maximum error in dial calibration should not exceed ±5 percent on bands 1 through 6 and ±1 percent on bands 7 and 8. The calibration accuracy of the tuning dial must be checked on at least 10 equally separated frequencies on each band. Follow the procedure in paragraph 67*a* to check the dial calibration. Use the 10 test frequencies chosen for this test, instead of those listed in paragraph 67.

76. Beat-Frequency Oscillator

The bfo should produce an audible beat note in the headset that can be adjusted by the B. F. O.-PITCH control 2 kc on either side of the zero beat. See paragraph 68 for bfo alinement.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

77. Disassembly

Disassembly of Radio Receiving Set AN/TRR–8 consists of disconnecting the accessories and replacing them inside the cover of the radio set case. To prepare it for transportation and storage, reverse the directions given in paragraph 16 for the installation of the radio set.

78. Repacking for Shipment or Limited Storage

a. The exact procedure in repacking for shipment or limited storage depends on the material available and the conditions under which the equipment is to be shipped or stored. Adapt the unpacking and uncrating procedures (par. 15) for repacking and recrating equipment.

b. Whenever practicable, place a dehydrating agent, such as silica gel, inside the package. Protect the package with a waterproof paper barrier sealed with waterproof sealing compound or tape. Pack the protected package in a padded wooden case, providing at least 3 inches of excelsior padding or some similar material between the paper barrier and the packing case.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

79. Authority for Demolition

The demolition procedures in paragraph 80 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

80. Methods of Destruction

a. Smash. Smash the tuning dial window, controls, tubes, coils, switches, capacitors, transformers, headsets, antennas, carrying case, and batteries; use sledges, axes, handaxes, pickaxes, hammers, crowbars, or heavy tools.

b. Cut. Cut cables, cords, headsets, and wiring; use axes, handaxes, or machetes.

c. Burn. Burn bag, cords, resistors, capacitors, coils, wiring, and manuals; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

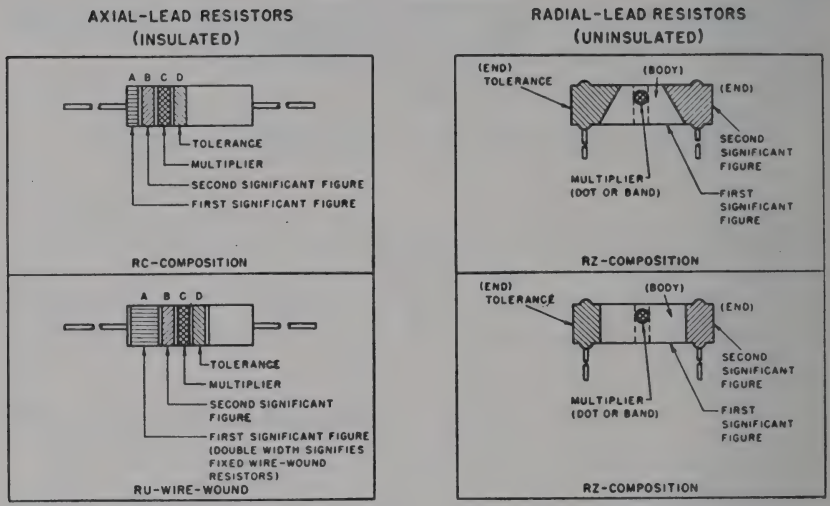
d. Bend. Bend panels, carrying case, and chassis.

e. Explode. If explosives are necessary, use firearms, grenades, or TNT.

f. Dispose. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. Destroy. Destroy everything.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)



RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

* FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR. THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

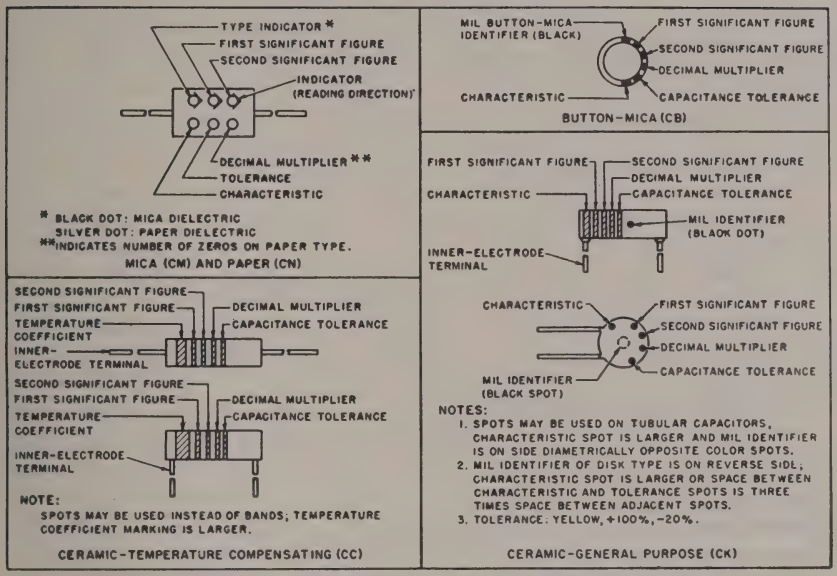
EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B, BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT. YELLOW BAND A, PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING).
10 OHMS ±20 PERCENT. BROWN BODY, BLACK END, BLACK DOT OR BAND, BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT. ORANGE BODY, BLACK END, RED DOT OR BAND, SILVER END

STD-R1

Figure 24. Resistor color codes.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE [2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UUF	10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500) [3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-CI

Figure 25. Capacitor color codes.

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[AG 413.44 (16 May 55)]

By order of the Secretary of the Army:

M. B. RIDGWAY,
General, United States Army,
Chief of Staff.

Official:

JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

CNGB (1)
Tec Svc, DA (1)
Tec Svc Bd (1)
CONARC (5)
CONARD Bd (Incl ea Test Sec) (1)
Army AA Comd (2)
OS Maj Comd (5)
OS Base Comd (5)
Log Comd (5)
MDW (1)
Armies (5)
Corps (2)
Tng Div (2)
Ft & Cp (2)
Gen & Br Svc Sch (5)
SigC Sch (25)
Gen Depots (2)
SigC Sec, Gen Depots (10)
SigC Depots (20)
POE (2)
OS Sup Agencies (2)
SigC Fld Maint Shops (3)
SigC Lab (5)
Mil Dist (1)
Units organized under following TOE's:
11–7, Sig Co Inf Div (2)
11–16A, Hq & Hq Co, Sig Bn, Corps or Abn Corps (2)
11–57, Armd Sig Co (2)
11–127, Sig Rep Co (2)
11–128A, Sig Depot Co (2)
11–500A (AA–AE), Sig Svc Org (2)
11–557A, Abn Sig Co (2)
11–587A, Sig Base Maint Co (2)
11–592A, Hq & Hq Co, Sig Base Depot (2)
11–597A, Sig Base Depot Co (2)

NG: State AG (6); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see SR 320–50–1.

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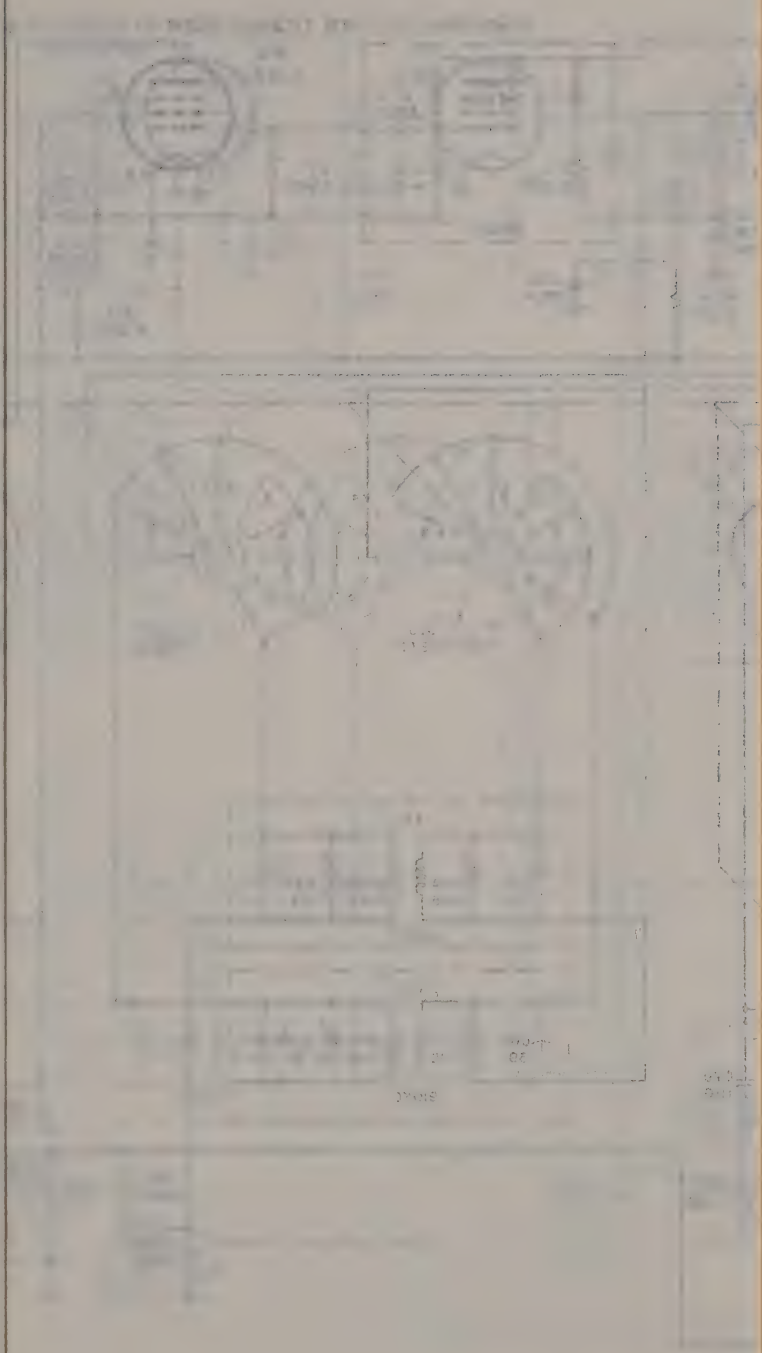

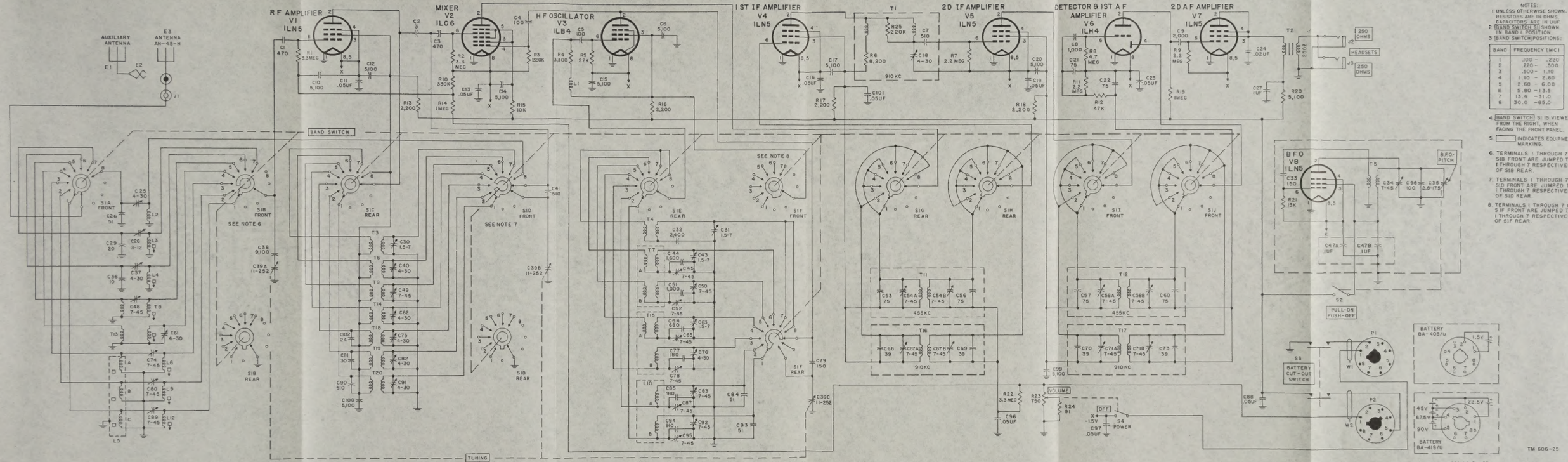

NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. BAND SWITCH S1 SHOWN IN BAND 1 POSITION.
3. BAND SWITCH POSITIONS:

BAND	FREQUENCY (MC)
1	.100 - .220
2	.220 - .500
3	.500 - 1.10
4	1.10 - 2.60
5	2.60 - 6.00
6	5.80 - 13.5
7	13.4 - 31.0
8	30.0 - 65.0

4. BAND SWITCH S1 IS VIEWED FROM THE RIGHT, WHEN FACING THE FRONT PANEL.
5. [ ] INDICATES EQUIPMENT MARKING.
6. TERMINALS 1 THROUGH 7 OF S1B FRONT ARE JUMPED TO 1 THROUGH 7 RESPECTIVELY OF S1B REAR.
7. TERMINALS 1 THROUGH 7 OF S1D FRONT ARE JUMPED TO 1 THROUGH 7 RESPECTIVELY OF S1D REAR.
8. TERMINALS 1 THROUGH 7 OF S1F FRONT ARE JUMPED TO 1 THROUGH 7 RESPECTIVELY OF S1F REAR.

Figure 26. Radio Receiver R-104/TRR-8, schematic diagram.

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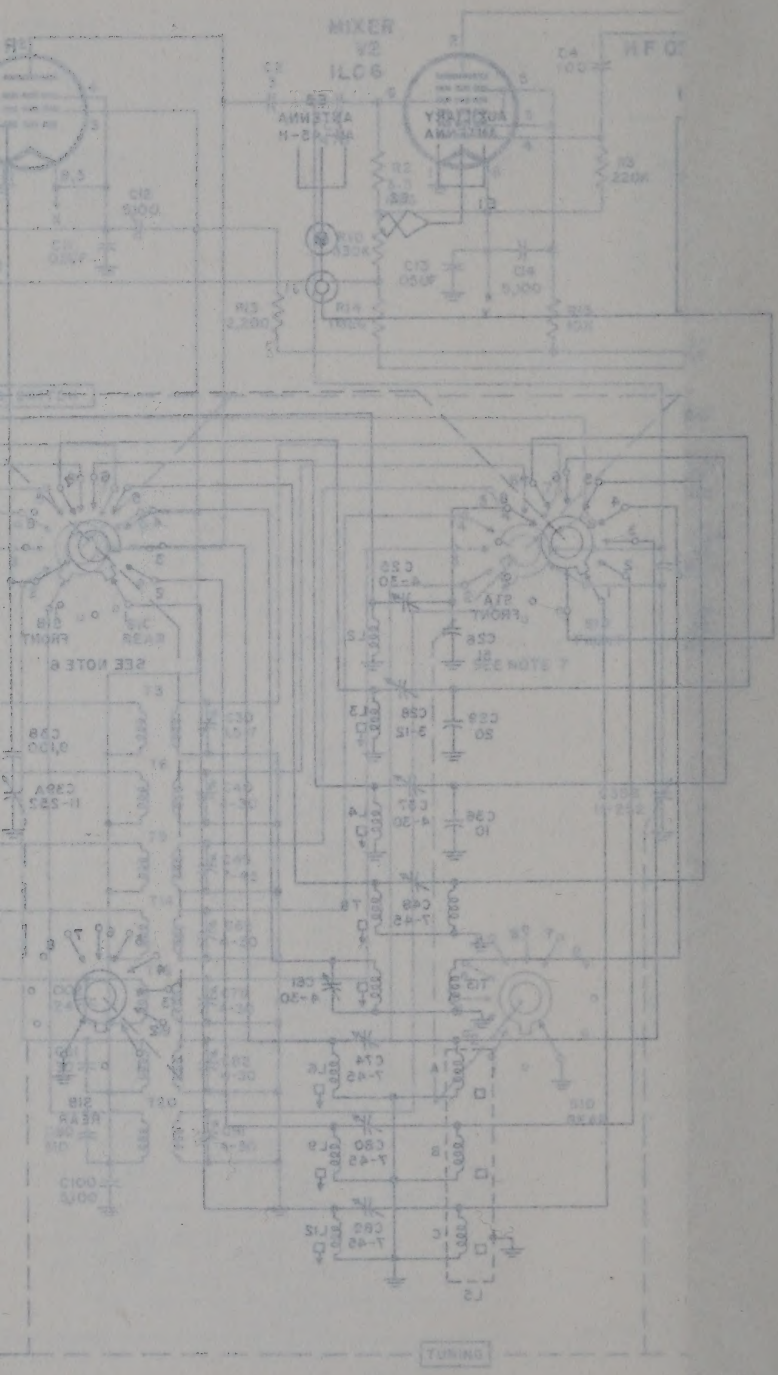
MIXER
V2
ECH81
ANTENNA
AUXILIARY
ANTENNA
TUNING